GUIDELINES ON MEDICAL SURVEILLANCE

Under the Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations, 2000 P.U.(A)131

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(Subregulation 27(3))

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PREFACE

These guidelines may be cited as the **Guidelines on Medical Surveillance**.

The purpose of these guidelines is to guide, clarify and elaborate on the content and frequency of medical surveillance to be conducted by the Occupational Health Doctor (OHD) in complying with the requirements of Regulations 27(2), **Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000.**

Employers are also encouraged to read these guidelines in conjunction with the **Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000** so that it will help them in fulfilling with the requirements of Regulations 27(1) for Health Surveillance Programme in a comprehensive and integrated approach.

Employers and employees must understand the rationale for and the importance of occupational health surveillance programme as this will improve their cooperation with the OHD in ensuring success of conducting the programme.

These guidelines will be reviewed from time to time. Assessors, hygiene technicians, occupational health doctors, employers, employees and others concerned are invited to gives their comments in writing or e-mail to the Department of Occupational Safety and Health, so that that these guidelines will be continuously improved thus making the maximum contribution to the prevention and control of occupational disease and poisoning thereby increasing organisational productivity and health of the working population.

Director General
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DEFINITIONS

"Assessor" means an employee or any other person appointed by the employer and registered with the Director General of DOSH to carry out assessments of risks to health.

"Biological Effect Monitoring" means the sub-clinical biological effect caused by the hazards.

"Biological Exposure Indices (BEIs)" are reference values intended as guidelines for the evaluation of potential health hazards in the practice of occupational hygiene. BEIs represent the level of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as workers with inhalation exposure at the TLV. These values are developed by ACGIH as a guide for biological monitoring of chemicals.

"Biological monitoring" means the measurement and assessment of agents or their metabolites either in tissues, secreta, excreta, expired air or any combination of these to evaluate exposure and health risk compared to an appropriate reference.

"Chemicals" means chemical elements or compounds or mixtures thereof, whether natural or synthetic, but does not include micro-organisms.

"Chemicals hazardous to health" means any chemical which :

a) is listed in Schedule I or II;
b) possess any of the properties categorised in Part B of Schedule I of the Occupational
   Safety and Health (Classification, Packaging and Labelling of Hazardous Chemicals) Regulations 1997;
c) comes within the definition of "pesticide" under the Pesticides Act 1974;
d) is listed in the First Schedule of the Environmental Quality (Schedule Wastes) Regulations 1989.

"Health surveillance" means any examination and investigations which may be necessary to detect exposure levels and early biological effects and responses, and includes biological monitoring, biological effect monitoring, medical surveillance, enquires about symptoms of occupational poisoning or occupational disease and review of records and occupational history.

"Hygiene technician" means an employee or any other person appointed by the employer and registered with the DG (DOSH) to carry out any inspection, examination or test on engineering control equipment installed in a place of work or to carry out chemical exposure monitoring**.**

"Medical surveillance" means the monitoring of a person for the purpose of identifying changes in health status due to occupational exposure to chemicals hazardous to health**.**

"Occupational Health Doctor" means a medical practitioner registered with the DG (DOSH) to conduct medical surveillance programme of employees.

"Occupational Medical Surveillance Records" means forms specified in this guidelines for the purpose of keeping of medical records.

"Permissible Exposure Limit (PEL) " means a ceiling limit or an eight-hour time-weighted average airborne concentration or the maximum exposure limit.

"Supplier" means a person who supplies chemicals and includes a formulator, a manufacturer and importer or a distributor.

"Time-weighted average (TWA)" in relation to airborne concentration means an average airborne concentration over a specified period of time.

"Use" means production, processing, handling, storage, transport, disposal and treatment.

1.0 INTRODUCTION

Malaysia is taking great steps to be an industrialised nation by the year 2020. This will entail heavy and extensive use of chemicals.

The Occupational Safety and Health (Classification, Packaging and Labeling) Regulations 1997 and the Manual of Chemical Health Risk Assessment 2000 helps employers to assess whether there is any significant exposure of the chemicals to the worker and further medical surveillance is necessary.

The Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000 is another attempt to further enhance the safe and healthy use of chemicals.

Under this Regulations health surveillance is necessary for chemicals hazardous to health as stipulated in the regulations. Medical surveillance carried out under the USECHH Regulations must be conducted by an Occupational Health Doctor (OHD).

2.0 LEGAL PROVISION

OCCUPATIONAL SAFETY AND HEALTH (USE AND STANDARD OF EXPOSURE OF CHEMICALS HAZARDOUS TO HEALTH) REGULATIONS 2000

PART IX
HEALTH SURVEILLANCE

Health surveillance programme

Regulation 27

(1) Where an assessment indicates that health surveillance is necessary for the protection of the health of employees exposed or likely to be exposed to chemicals hazardous to health, the employer shall carry out a **health surveillance programme.**

(2) If an employee is exposed or likely to be exposed to **chemicals hazardous to health listed in Schedule II**, and is engaged in a process specified therein, the health surveillance required under sub-regulation (1) shall include medical surveillance conducted by an **occupational health doctor** at intervals of not more than twelve months or at such shorter intervals as determined by the occupational health doctor or an occupational safety and health officer who is also a medical practitioner.

(3) The employer shall ensure that the health surveillance record or a copy there of is maintained in good order and condition and kept for a period of thirty years from the date of the last entry made in it.

(4) The employer shall make available upon request all records required to be maintained under sub-regulation (3) to the DG (DOSH) for examination and inspection.

(5) The employer shall, after a reasonable notice being given, allow any of his employees access to the health surveillance record which relates to the employee.

PART X

MEDICAL REMOVAL PROTECTION

Regulation 28

(1) The employer shall not permit an employee to be engaged in and shall remove him from any work that exposes or likely to expose him to chemicals hazardous to health on each occasion that the medical finding, determination or opinion expressed by an occupational safety and health officer who is also a medical practitioner or by an occupational health doctor shows that the employee has a detected medical condition which places him at increased risk of material impairment to health from exposure to chemicals hazardous to health.

(2) The employer, after being notified by an occupational safety and health officer who is also a medical practitioner or an occupational health doctor of the fact, shall not permit a pregnant employee or breast-feeding employee to be engaged in, and shall remove the employee from work which may expose or is likely to expose the employee to chemicals hazardous to health.

(3) The employer shall return an employee to his former job -

(a) for an employee removed in accordance with sub-regulation (1), when a subsequent medical determination results in a medical finding, determination or opinion which shows that the employee no longer has the detected medical condition; or

(b) for an employee removed in accordance with sub-regulation (2), at the appropriate time where the employee is no longer pregnant or breast-feeding a child.

(4) For the purposes of this regulation, "medical practitioner" means a medical practitioner registered under the Medical Act 1971 [Act 50].

3.0 THE OBJECTIVES OF THE GUIDELINES ON MEDICAL SURVEILLANCE

The **objective** of this GUIDELINES ON MEDICAL SURVEILLANCE is to help **occupational health doctors (OHD),** registered with DOSH to implement the guidelines according to Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000.

4.0 COMPONENTS OF MEDICAL SURVEILLANCE

The components of Medical Surveillance Programme include :

- Pre-employment and pre-placement medical examination.
- Biological monitoring and biological effect monitoring.
- Health effects monitoring.
- Investigation of occupational disease and poisoning including workplace inspections.
- Notification of occupational disease and poisoning.
- Assist in disability assessment.
- Return to work examination after medical removal protection.
- Record keeping and monitoring.

5.0 DUTIES OF OCCUPATIONAL HEALTH DOCTOR (OHD)

(1) Conduct the pre-employment and pre-placement medical examination (baseline medical data) of employees to assess fitness for work, taking into consideration the hazards and risk assessment in the workplace. The use of Occupational Medical Surveillance Programme Record Book and Employee Record Book is suggested.

(2) Determination of the ability to work while wearing the Personal Protective Equipment.

(3) Maintain the medical records of employees during the course of employment (periodic) and post termination.

(4) Documentation of employee exposure to hazards at workplace.

(5) Interpret and explain the results of investigations to the EMPLOYEE AND EMPLOYER and specify what further follow up action is necessary.

(6) Analysis of Occupational Diseases & Poisoning and co-relate with Chemical Health Risk Assessment.

(7) Investigation of the cause of the Occupational Disease / Poisoning. Visit work place and recommend remedial actions. For medical removal protection use the appropriate forms.

(8) Notification of Occupational Diseases & Poisoning to DOSH and employer.

(9) Assist in Implementation of Occupational Health Programme in the workplace.

(10) Assist in the management of Occupational Diseases & Poisoning including removal from work, treatment, rehabilitation, disability assessment, return to work and / or compensation.

(11) Reinforce the value of education/ training in Occupational Health to both employer and employee.

(12) Assist in Audit / Evaluation of Occupational Health Programme in the workplace.

6.0 DUTIES OF EMPLOYER

(1) Carry out health surveillance programme as required by the assessment report under USECHH Regulations.

(2) Health surveillance programme shall be conducted during the working hours and the costs shall be borne by the employer.

(3) Appoint an Occupational Health Doctor, (OHD) to conduct occupational medical surveillance programme.

(4) Allow and assist the OHD to visit the workplace to investigate and manage occupational disease and poisoning including access to relevant monitoring and other health related data.

(5) Co-operate with the OHD in medical removal protection of the worker.

(6) During the period of medical removal the worker may be allowed to do other work that will not expose him to the hazardous chemical.

(7) Notify occupational disease and poisoning to DOSH .

(8) Notify the workers concerned regarding monitoring of exposure levels of chemicals hazardous to health including occupational disease and poisoning.

(9) Allow the employee access to occupational medical surveillance records.

(10) Ensure the workplace hygiene is improved, is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to chemical hazardous to health. before allowing the worker to work in the same place so as to ensure the disease or poisoning does not reoccur.

(11) Record Keeping of diseases and accidents.

(12) Provide Employee Medical Book.

7. DUTIES OF EMPLOYEE

(1) Undergo training on importance of preventing occupational poisoning and disease.

(2) Report early symptoms and signs of disease (including self examination) to the OHD and management.

(3) Comply and co-operate in the Occupational Medical Surveillance Programme, as required under USECHH.

(4) To take proper care of the Employee Record Book and to present it to OHD for Occupational Medical Surveillance record purposes.

1. 4- AMINODIPHENYL

1.0 SYNONYMS: p-aminodiphenyl, 4- aminobiphenyl, biphenylamine, p-phenylaniline and xenylamine.
It is an aromatic amine.

PEL 8 hr TWA : 0

Physicochemical properties
Colourless to straw coloured liquids and crystals.
On combustion, forms toxic gases.

Route of Absorption
Inhalation, Dermal (**skin**)

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Organic chemical synthesis including solvents, perfume manufacture
- Dye intermediate, photography, rubber industry
- Used as heat transfer agents.

3.O TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Headache, dizziness, lethargy, ataxia
- Anorexia, vomiting
- Irritation of eye, skin & respiratory tract
- Burning urinary sensation due to acute haemorrhagic cystitis

3. 2 CHRONIC EFFECTS

- Bladder tumours. **Confirmed carcinogen (IARC 1). A1 (ACGIH)**
- Liver, Kidney, CNS, Nerve damage.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Indicated for exposure to 4-Aminodiphenyl or possibility of excessive absorption.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular attention to:

- Kidneys- Urine cytology
- Neurological and
- Respiratory system

4.2 PERIODIC MEDICAL EXAMINATIONS

Annually but much more frequently if exposure is high.

- Urine cytology
- Methaemoglobinemia (if levels of 4- aminodiphenyl exceed PEL)

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning / disease and excessive absorption.

All cases of Medical Removal Protection (MRP), cases of definite or suspected poisoning / disease and excessive absorption must be notified to the Director General (DG), Department of Occupational Safety and Health (DOSH).

6.0 FOLLOW-UP ACTIONS

6.1 ABNORMAL RESULTS

If symptoms & signs including abnormal urine cytology persist, a repeat test must be done immediately.

Refer to **urologis**t for further examination.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All medically removed workers should have repeat urine investigations and relevant biochemical tests within one month.
- ❖ The worker should not return to work until the signs and symptoms, abnormal cytology and biochemical results have recovered.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to 4-Aminodiphenyl.

6.3 TREATMENT

All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work-process & workplace hygiene, adequate ventilation and appropriate signage.
- ❑ Personal protective equipment, Chemical goggles.
- ❑ Cigarette smoke contains Aminobiphenyl, as such it is advisable for the worker not to smoke.
- ❑
- ❑ Aminobiphenyl is prohibited in the use for manufacture & use for all purposes except for research & analytical purposes in Malaysia.

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family Medicine, National University of Singapore 1997.
2. Olson KR. Poisoning & Drug overdose, A Lang Clinical manual: Prentice-Hall Int. (UK) Ltd., London; 1999: 438t.
3. Plunkett ER Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio; 1987:155-6.
4. Aromatic Hydrocarbon, in International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998:104.273.
5. Rom MN Environmental & Occupational Medicine 2nd Edition Little Brown & Co.Boston, 1992: 882,1213, 1379.
6. OSHA Reg. (Stds -29 CFR) Aminodiphenyl 1926-1111.
7. www.osha.slc.gov
8. Information on the Prohibition of Substances form Certain Purposes. DOSH, 1999:2.

2. ARSENIC AND ANY OF ITS COMPOUNDS

1.0 SYNONYMS: Arsenic Trichloride, Arsenic Trioxide, White Arsenic

PEL 8 hr TWA:

Arsenic
(elemental & inorganic 0.01 mg/m3)
Arsine 0.05 ppm
Arsine-ILH
(Immediate Lethal to Health) 150 ppm

Physicochemical properties

Elemental arsenic is silvery lustrous metalloid. Arsenic compounds arsenic (III) oxide, arsenic (V) oxide, the acids formed from these oxides and their salts and organic compounds are more commonly encountered than arsenic metal.

Trivalent arsenic is 2-10 times more **toxic** than the pentavalant form.

Route of Absorption

Inhalation

Arsenic particles may be deposited in the upper respiratory tract, cleared from upper respiratory tract and swallowed and absorbed from the gastrointestinal tract.

Ingestion

Skin absorption is from open abrasions. Arsenic acids may be absorbed through intact skin.

Bio-transformation

Trivalent arsenic may be oxidized in the body to the heptavalent state. The opposite can take place. Inorganic arsenic is ethylated to form dimethylarsenic acid and methylarsenic

acid. Once absorbed, arsenicals disrupt enzymatic reactions vital to cellular metabolism by interacting with sulfhydryl groups (trivalent Arsenic or substituting for phosphate (pentavalent arsenic).

Excretion

Most of the absorbed arsenic is excreted in the urine, with small amounts being excreted in the faeces. The maximum excretion occurs in the first 6 hours, with about 25% being excreted in 24 hours and about 75% within 7 days of exposure.

Half-life of inorganic arsenic is ½ hour and has ethylated metabolites 5-20 hours.

TOXIC EFFECTS OF ARSENIC AND ANY OF ITS COMPOUNDS

A: *INORGANIC ARSENIC*

B: *RGANIC ARSENIC*

***C: ARSINE* (AsH3)**

2.0 OCCUPATIONS INVOLVING RISK OF EXPOSURE TO

A: *INORGANIC & B: ORGANIC ARSENIC*

- Manufacture and use of pesticides (weed killers, fungicides, wood preservatives) in tanning, wood preservation, horticulture
- Manufacture of semiconductors
- Gallium arsenide substrate production and wafer processing

- Cleaning and maintenance of iron implant machines
- Handling of iron source
- Manufacture of alloy (with copper or lead) & glass
- Smelting of arsenical (especially non-ferrous) ores.
- Dust generated during grinding, screening, transfer and maintenance work on furnaces, flues and filters
- Manufacture and use of organic arsenical compounds e.g. arsphenamine, neoarsphenamine, sulpharsphenamine and tryparsamide, veterinary pharmaceutical products
- Pigment manufacture and use
- Manufacture and use of anti-fouling paints.
- Arsenic waste disposal.

3.0 TOXIC EFFECTS OF A: *INORGANIC* ARSENIC

3.1 ACUTE EFFECT OF A: *INORGANIC ARSENIC*

Acute poisoning is rare and is usually accidental. If ingested, symptoms of throat constriction, dysphagia, epigastric pain and vomiting and watery diarrhea develop within 1/2 to 4 hours. Fatal dose of ingested elemental arsenic is 70-180 mg. If not fatal, exfoliative dermatitis and peripheral neuritis may develop.

If inhaled arsenic dust and fumes cause irritation, rhinitis, cough, chest pain, dyspnea, laryngitis, pharyngitis may occur. Ingestion causes vomiting, dysphagia, diarrhea, abdominal pain, dehydration and shock.

3.2 CHRONIC EFFECT OF A: *INORGANIC ARSENIC*

Skin	Increased pigmentation, (after 3 –7 years), desquamation, herpetic-like lesions about the mouth, hyperkeratosis (especially of palms and soles), skin cancer.
Nails	Mee's line (2-3 weeks post ingestion). Hair loss.
Respira - tory tract	Perforation of nasal septum, chronic bronchitis, basilar fibrosis of lung. Lung cancer.
	Fatty infiltration.

Liver	Liver cirrhosis, chronic hepatitis.
Nervous system	Encephalopathy, convulsions, hyperpyexia, coma, tremor. Peripheral neuritis – axonal degeneration, initially sensory (loss of sensation), later motor weakness.
Haemato – Poietic System	Normochromic anaemia, neutropenia. Thrombocytopenia, aplastic anaemia, RBC basophilic stripling.
Gastro-intestinal	Dyspahgia, mucosal erosion, abdominal pain
Kidney	Tubular & glomerular damage. Oliguria, uremia.

3.3 OTHER CONDITIONS A: *INORGANIC ARSENIC*

- Cancer of skin, lungs and ethmoids reported. Skin cancer presents with pigmentation, keratosis and single or multiple malignant growths **(IARC 1)**
- Basal or squamous cell type
- Genotoxic: chromosomal aberrations in human lymphocytes

Note: *Some inorganic arsenic compounds (e.g. arsenic acid, arsenic trichloride) can be absorbed through intact skin. Inorganic arsenicals are generally more toxic than organic arsenicals.*

4.0 MEDICAL SURVEILLANCE PROGRAMME FOR *ARSENIC & ITS COMPOUNDS*

Any occupational exposure to arsenic and its compounds > 50% PEL or possibility of excessive absorption.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS FOR A: INORGANIC ARSENIC

Clinical examination & baseline data with particular emphasis on the:

- Nervous system
- Liver**,** liver function tests (Serum bilirubin, alkaline phosphatase, alanine and

aspartate transaminases and gamma-glutamyl transpeptidase)

- Skin
- Nasal septum**,** lungs and lymph nodes.
- History of smoking, medicines taken, alcohol consumption, previous job.
- Estimation of urinary arsenic content in an early morning urine specimen (with creatinine correction). Ensure that worker avoids seafood for three days prior to urine collection.

Fish and shellfish contain very large amounts of organically bound arsenic and these are readily absorbed from the GIT and quickly excreted in the urine.

- Full-sized chest x-ray examination (at pre-employment examination only).

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling Time	BEI
Arsenic and soluble compounds including arsine (Inorganic arsenic plus methylated metabolites in urine)	End of work week	35µg/L

Source: TLVs & BEIs ACGIH, 2000.

As the half-life is short; therefore Blood As is less useful than urine levels. Urinalysis is by far the most reliable procedure for monitoring employees exposed to arsenic. Unexposed individuals normally show levels above 0.05 mg/L.

4.2 PERIODIC MEDICAL EXAMINATION

A: *INORGANIC ARSENIC*

- Done annually. Detect early skin changes, (hyperpigmentation and thickening).
- Regular self-inspection of skin by workers is appropriate.

4.3 WHERE INDICATED THE FOLLOWING TESTS MAY BE DONE FOR *INORGANIC ARSENIC*:

- Estimation of inorganic arsenic, urinary monomethylarsenic acid (MMA) and dimethylarsenic acid (DMA) in an early morning urine specimen
- Complete blood count including differential count
- Sputum cytology estimation
- Kidney function tests.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

A: *INORGANIC ARSENIC*

- All cases of definite or suspected arsenic poisoning and excessive absorption.

- Cases with urine arsenic levels of more than 300 µg/ L in 2 successive examinations.
- All cases with evidence of cancer.
- All breast-feeding & pregnant women
- Workers with persistent liver abnormalities (one or more abnormal result in the liver function on at least 2 occasions, the test being carried out preferably not more than one month apart).

B: ORGANIC ARSENIC

2.0 TOXIC EFFECTS OF *ORGANIC ARSENIC*

Skin and mucous membrane irritation.

C: ARSINE

Most toxic form of arsenic

Has poor olfactory warning property. Non-irritating, colorless, neutral gas, slightly soluble in water.

2.0 OCCUPATIONS INVOLVING RISK OF EXPOSURE TO ARSINE

- Accidental exposures during tin refining, cleaning of tanks containing acid sludge, smelting and chemical industries
- Used in organic synthesis
- Is a byproduct of metal smelting
- Manufacture of solid state semiconductors;
- Accidental leakage, explosion or equipment, malfunction during use as a dopant gas.

3.0 TOXIC EFFECTS OF *ARSINE*

- Causes massive intravascular haemolysis
- Symptoms develop within hours of exposure
- Triad of **haemoglobinuria** (port-wine urine), **jaundice** (coppery-bronze hue) and **abdominal pain.**
- Associated shivering, severe thirst and ECG changes
- Death is due to acute renal failure. (Haemolyses & haemoglobinuria)

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS FOR C: *ARSINE*

Clinical examination & baseline data with particular emphasis on the:

- Liver, liver function tests (Serum bilirubin, alkaline phosphatase, serum transaminases e.g. SGOT, SGPT, gamma-glutamyl transpeptidase)
- Renal -Urine dipstick examination for protein and blood.
- Hematological systems - Hemoglobin estimation and peripheral blood film examination to look for basophilic stippling.

To exclude workers with cardiac or renal disease and those with hypersensitivity to hemolytic agents.

- Estimation of urinary arsenic content in an early morning urine specimen (with creatinine correction). Ensure that the worker avoids seafood for 3 days prior to

urine collection as it may contain arsenic.

4.2 PERIODIC MEDICAL EXAMINATION C: *ARSINE*

Annually as for pre-employment.

Renal function tests.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION C: *ARSINE*

- All cases of definite or suspected arsine poisoning and excessive absorption.
- All cases with urine arsenic levels of more than 300 µg/L in 2 successive examinations.
- All cases with anaemia, proteinuria or haematuria.
- (**Note**: Each laboratory has its own 'normal range' for haemoglobin. The lower limit of this range, subject to a margin of error of up to 5%, depending on the laboratory, may be taken as the level for the diagnosis of anemia**)**.
- All pregnant and breast-feeding women where exposure is 50% of PEL.
- Workers with persistent liver abnormalities (one or more abnormal result in the liver function test on at least 2 occasions, the tests being carried out preferably not more than one month apart).

All cases recommended for suspension and suspected cases of arsenic/arsine poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTIONS

6.1 ABNORMAL RESULTS – ARSENIC

- If the urine arsenic level exceeds 300 µg/ L, a repeat test must be done immediately.
- Cases with abnormal liver function tests should be investigated to exclude effects due to arsenic.
- Cases with anemia, proteinuria or haematuria should be investigated to exclude effects due to arsine.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine arsenic examinations at 3-monthly intervals and should not return to arsenic work until the urinary arsenic level falls below 300 µg/litre and symptoms have disappeared
- Cases with definite evidence of cancer should preferably not continue with arsenic or arsine work.

- ❖ The worker may return to work with arsenic when the liver function results return to normal and he is clinically asymptomatic.

- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to arsenic.

6.3 TREATMENT

- First Aid: Evaluate & support (ABC's Airway breathing & circulation) Administer charcoal if available.
- Refer for hospital treatment. BAL is the antidote for inorganic arsenic including haemolysis.
- Other chelating agents are not effective for arsenic poisoning.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work process
- ❑ Improvement work-place hygiene
- ❑ Use of approved Personal Protective Equipment
- ❑ Appropriate signage.

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family Medicine, National University of Singapore 1997.

2. National Institute for Occupational Safety and Health: Criteria for a Recommended Standard. Occupational exposure to inorganic arsenic (new criteria -1975). US Department of Health, Education and Welfare, USA. (HEW Publication No (NIOSH) 75 -149), 1975.

3. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.

4. Employment Medical Advisory Service: Occasional Paper 1, Biochemical Criteria in certain biological media for selected toxic substances, Dept of Employment, UK, 1974.

5. Occupational Safety & Health Authority: Medical Surveillance Guidelines 1910.1018 App C, 1989.

6. World Health Organisation: Early detection of occupational diseases. Chapter 12, Diseases Caused by arsenic and its toxic compounds, 1986: 74-8.

7. Donald S Herip: Recommendations for the investigation of abnormal hepatic function in asymptomatic workers. Am J Ind Medicine, 1992; 21: 331-9.

8. American Conference of Governmental Industrial Hygienist: Documentation of the Threshold Limit Values and Biological Exposures Indices, Cincinnati 1999.

9. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation 11-Health Surveillance-Arsenic in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989:1/5.

3. ASBESTOS

1.0 PHYSICOCHEMICAL PROPERTIES

It is a term form for a group of naturally occurring fibrous mineral silicates. There are 2 groups and 6 mineral types:

Sepentine group	Amphibole group
Chrysotile	crocidolite, amosite, anthophylite, tremolite, actinolite.

PEL 8hr TWA: 0.1 f /ml.

Route of entry

Inhalation

2.0 OCCUPATIONS AT RISK OF EXPOSURE

Asbestos milling and processing

- Manufacture and use of asbestos-cement products e g. roofing sheets, wall boards, fireproof cloth, brakes and clutch linings, rubbish chutes in high rise buildings.
- Manufacture of gaskets.
- Ship building and repairing e.g. in lagging and delagging of boilers and pipes.
- Construction industry e.g. sawing and grinding of asbestos boards used in roofing and fireproof doors/partitions.
- Renovation/demolition work e.g. old buildings, power stations where asbestos material may have been used.
- Manufacture and repair of brake linings e.g. car and bus mechanics.
- Insulation work e.g. removal or replacement of asbestos insulation of furnaces, ovens etc.

3.0 TOXIC EFFECTS

Signs of toxicity are usually delayed at least 15-30 years.

- Pleural plaques
- Mesothelioma (cancer of the pleural or mediastinal)
- Benign pleural effusion
- Asbestosis-fibrosis with shortness of breath and cough
- Chronic bronchitis
- Bronchogenic Cancer (cigarette smoking is an important synergistic factor and the risk may be increased by more than 50 times when compared to a non- smoker and unexposed worker)
- Cancer of larynx.
- Gastro-intestinal cancers (some evidence particularly the oesophagus, stomach, colon)

Asbestos is a confirmed human carcinogen (IARC 1)

4.0 MEDICAL SURVEILLANCE PROGRAMME

Please refer to the Factories & Machinery (Asbestos Process) Regulations 1986.
Any occupation where workers are liable to be exposed to airborne asbestos fibers above PEL or possibility of absorption.

4.1 PRE- PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular emphasis on the:

- Respiratory system (medical, occupational, smoking history, exert ional dyspnoea, basal crepitations)
- Pulmonary function test by spirometry, forced vital capacity (FVC), forced expiratory volume in one second (FEV1).
- Full-size chest x-ray examination (350 mm by 430mm)

4.2 PERIODIC MEDICAL EXAMINATIONS

- Annual clinical examination with particular emphasis on the lungs (basal crepitations). Ask for any history of exertional dyspnoea
- Repeat full-size chest x-ray examination if indicated and once in 36 months.

Note: **It is not yet established whether the disease can be diagnosed at a stage when progression would cease if further exposure to asbestos is avoided.**

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Sputum examination for asbestos bodies, abnormal cells.
- Carbon monoxide transfer factor

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- An early state of asbestos induced disease or diseases have occurred
- A worker is symptomatic
- There is progressive deterioration in CXR findings in a worker less than 35 years old

All cases recommended for MRP and definite or suspected cases of asbestosis or mesothelioma and bronchogenic carcinoma must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

- Cases of suspected asbestosis (category 1/0*) should have a repeat full- size chest x-ray and clinical examination after one year.
- Cases of definite asbestosis (category 1/1 or above* in 2)
- Consecutive films should be followed up annually (full size chest x-ray and clinical examination) or more frequently to exclude complications.

6.2 MEDICALLY REMOVED WORKER AND RETURN TO WORK

- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to Asbestos.

- ❖ Suspended asbestosis cases should be followed up annually or more frequently to exclude complications.

Note: *The chest radiographs should be compared with the set of standard films of ILO 1980 (Classification of Radiographic appearances of the Pneumoconiosis. Reference No. 6)

6.3 TREATMENT

- •There is no definitive treatment for asbestosis.
- •All cases of suspected bronchogenic cancer or mesothelioma should be referred to specialist for further management in a chest hospital / clinic.
- •Symptomatic asbestosis cases may require treatment as and when indicated.

7.0 PREVENTIVE MEASURES

- ❑ Young persons under 18 years of age should not be exposed to asbestos.
- ❑ Workers should be advised to stop smoking as smoking has synergistic effect on likelihood of lung cancer if there is asbestos exposure.
- ❑ Crocidolite is prohibited for all purposes except for research & analytical purposes in Malaysia.
- ❑ Appropriate signage.

8.0 REFERENCES

1. The Factories and Machinery (Asbestos Process) Regulations 1986.
2. Gilson JC: Asbestosis In: Encyclopedia of Occupational Health and Safety International Labour Office Geneva, 3rd edition; 1983 : 187-91.
3. National Institute for Occupational Safety and Health: Criteria for a recommended standard. Occupational exposure to asbestos. U .S. Department of Health, Education and Welfare, USA, 1972 (HSM 72-10267).
4. International Labour Office: Occupational Safety and Health Series No: 30 Asbestos: Health Risks and their Prevention. ILO, Geneva, 1974.
5. Asbestos, Health and Safety. Proceedings of the World Symposium on Asbestos, Montreal, Canada, May 1982.
6. ILO U/C International Classification of Radiographs of Pneumoconiosis. Revised edition 1980.
7. Occupational Safety and Health series 22 (rev 80) (International Labour Office, Geneva), 1980.
8. World Health Organisation: Pneumoconiosis In: Early detection of occupational diseases, Geneva, 1986: 9-25.
9. World Health Organisation: Screening and Surveillance of Workers Exposed to Mineral Dusts, editor: G.R. Wagner, Geneva, 1996.
10. Control of Substances Hazardous to Health (COSHH) Regulations:

Regulation11-Health Surveillance-Asbestos in The Health and Safety Fact book Health & safety Executive, Professional Publishing Ltd. London, 1989: 1/6.

11. Criteria for the diagnosis of Occupational Lung Asbestos related lung disease. Diseases, Ministry of Health 1997:18.

4. AURAMINE

1.0 SYNONYMS

Tramethyl diaminobenzophenoimide, Aniline 4, 4 (imidocarbonyl) bis (N, N Dimethyl: HCL)

PEL 8hr TWA: 0

Physicochemical properties

Yellow powder

Route of Absorption

Inhalation

Skin, eye

2.0 OCCUPATIONS AT RISK OF EXPOSURE

Manufacture of Antiseptics & Dyes

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Dermatitis & burns, eye & skin irritation
- Headache, coughing, dizziness, difficulty in breathing
- Nausea & Vomiting
- Yellow Vision

3.2 CHRONIC EFFECTS

- Haematuria- bladder cancer
- Central nervous system
- Sub-clinical stage with vague symptoms

IARC Group1 Human Carcinogen & NTP Human Carcinogen

Tumours in bladder

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to auramine.

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data with particular attention to:

- Nervous system
- Skin
- Eye
- Respiratory system
- Urine cytology

4.2 PERIODIC MEDICAL EXAMINATION

- Monthly urinalysis of exposed personnel: PAP smears of urine every 6 months,
- Cystoscopy where indicated
- Annual collection of urine samples for examinations of cell shed from the bladder is recommended.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS:

If there are abnormal results, a repeat test must be done immediately & refer to **urologist.**

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and

does not place the worker at increased risk of material impairment to health from exposure to Auramine.

6.3 TREATMENT

All cases of poisoning must be immediately removed from exposure and refer for hospital treatment.

7.0 PREVENTIVE MEASURES

- Adequate ventilation
- Approved Personal Protective Equipment
- Chemical goggles & Good personal hygiene
- Appropriate signage.

8.0 REFERENCES

1. International Labour Office: Encyclopedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
2. Plunkett, ER Handbook of Industrial Toxicology Heyden, 1987:45.

5. BENZIDINE

1.0 SYNONYMS: Para-Diaminodiphenyl, Diaminobiphenyl

Physicochemical properties: White or slightly reddish, crystalline powder.

It is an aromatic amine. Breakdown products include oxides of nitrogen.

PEL 8 hr TWA: 0

Route of absorption

Extremely well absorbed through inhalation & skin. Ingestion.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical synthesis
- Dyes, textile dyeing & finishing industry, paper, leather (tanning) goods
- Rubber industries
- Analytical laboratories.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Hemorrhagic cystitis, Haematuria.
- Secondary anaemia from haemolysis.
- Hepatic disorders.
- Dermatitis.

3.2 CHRONIC EFFECTS

Confirmed human Carcinogen (IARC1)

Bladder cancer

- Central nervous system
- Sub-clinical stage of disease presents with vague symptoms

4.1 MEDICAL SURVEILLANCE PROGRAMME

Workers who are exposed to benzedine or where there is significant risk of absorption.

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data with particular attention to:

General

- Liver function test, kidney function test, total blood count.

Specific

- Urine cytology examination, blood & abnormal cells
- Urine benzidine

Diagnostic criteria/ investigation

Benzidine (unchanged) in urine is used as index of exposure. More than **10 µg/l** in random urine is an **index of exposure**. Determination of benzidine or its metabolites in **blood** is **not** routinely performed.

Recommended guidelines for bladder cancer screening

	Known carcinogen	Suspect carcinogen
High exposure	**Cytology every 6 months, RBC test every 6 months**	Cytology every 6 months, RBC test every 6 months
Low exposure	Cytology after 2 years, then after every 5 years	Cytology depending on circumstances Cytology

Source: Goldstein MD Chapter 70 Bladder Carcinogens and Surveillance in Rom WN Environmental and Occupational Medicine.

4.2 PERIODIC MEDICAL EXAMINANTION

Annually as per Pre-placement

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning / excessive

absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If the levels are excessive, repeat urine cytology must be done immediately and referred to the **urologist.**

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine / blood test.
- ❖ The worker can return to work if there are no symptoms and signs of disease and urine cytology is normal.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to Benzidine.

6.3 TREATMENT

All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.

7.0 PREVENTIVE MEASURES

- ❑ Substitute other less toxic dye for benzidine
- ❑ Engineering controls for chemicals. closed process systems, liquid metering systems, walk-in hoods, and specific local exhaust ventilation. Suitable collectors to prevent ambient air contamination.
- ❑ Good house keeping & occupational hygiene practices
- ❑ Establish restricted areas, inform employees of adverse effects, provide Health Hazard alert.
- ❑ Provide wash room / shower facilities
- ❑ Use approved Personal Protective Equipment.
- ❑ Prohibited in the use for manufacture & use for all purposes including any manufacturing process except for research & analytical purposes.
- ❑ Appropriate signage.

8.0 REFERENCES

1. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
2. Plunkett, ER Handbook of Industrial Toxicology Heyden, 1987: 53-4.
3. Employment Medical Advisory Service. Occasional Paper 1, Biochemical Criteria in certain biological media for selected toxic

substances. Dept. of Employment, UK, 1974.

4. National Institute for Occupational Safety and Health, Occupational Diseases -USA.

5. A Guide to their Recognition, Rev Ed, US Department of Health, Education and Welfare, USA, 1977. (DREW Publication No (NIOSH) 77-181).

6. World Health Organization. Recommended Health-based Limits in Occupational Exposure to Heavy Metals - Report of a WHO Study Group, Technical Report Series 647, 1980.

7. Http:// www.cdc.gov/niosh

8. Goldstein MD Chapter 70 Bladder Carcinogens and Surveillance in Rom WN Environmental and Occupational Medicine, Little Brown & Co. Edition 1992: 881-6.

9. Mycroft FJ, Hiatt PH. The toxic hazards of industrial and Occupational chemicals In: Olson KR, Poisoning & Drug Overdose by California Poison Control System, A Lang clinical manual, Prentice Hall Int. (UK) Ltd. London, 1999:427-42.

10. Information on the Prohibition of Substances from Certain purposes. DOSH, 1999:2.

6. BERYLLIUM

1.0 SYNONYMS: Glycinum, Glucinium, Beryllium chloride, Beryllium flouride, Beryllium nitrate

PEL 8 hr TWA: 0.002 mg/m3.

Physicochemical properties

Light greyish white metal, slightly soluble in acids and alkalis. Its salts are mostly white & flammable.

Route of Absorption

Inhalation- (mainly)

Some through the gastrointestinal tract

Crosses placental barrier and reaches the foetus

Excretion

Via urine and faeces

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Ceramic & refractory products, aircraft engine part production & spacecraft technicians
- (Beryllium, copper and other alloys in electrical contacts, switches, welding electrodes) nuclear reactor workers
- Metallic alloys workers, cathode
- Ray-tube makers
- Beryllium extraction
- Lithography for electronics.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Is caused by Beryllium (chloride, sulphate, fluoride) inhalation
- Cough, nasopharyngitis, tracheobronchitis, bronchiolitis, and pneumonitis pulmonary oedema a few hours to 1-2 days after exposure.
- Inhalation causes bronchitis, severe pneumonitis
- Nasal septum perforation
- Skin irritation allergic contact dermatitis, Conjunctivitis
- Sensitizer, ulcer, subcutaneous granuloma.

3.2 CHRONIC EFFECTS

- Is caused by **relatively insoluble (**metallic & its oxide**)** due to the allergenic effect**.**
- Disease may develop many years after cessation of beryllium exposure**.** Delayed on set up to 20 years.
- Granuloma in lungs pulmonary fibrosis and in other organs liver, spleen etc. is typical. -Chronic Beryllium Disease
- Berylliosis (interstitial lung disease)

Symptoms: cough, dyspnoea, and breathlessness on exertion, fever.

Signs: Rapid weight loss later.

There is limited evidence of carcinogenicity in humans

(IARC 1), ACGIH A1

Beryllium is a carcinogen in test animals.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the -in-air standard, and or where there is significant risk of absorbing it.

Diagnostic criteria/ investigation

- Chest X-rays- diffuse, bilateral, granulomatosis, or in early stages only enlarged lymph nodes. Radiologist report is necessary.

- Pulmonary function Tests
- Respiratory function is impaired by reduction in diffusion capacity of the lungs, which is detectable in early stages of the disease.

Beryllium in urine does **not confirm exposure as those not occupationally exposed can have concentrations usually less than 1 mg/l**.

Urine Beryllium is a useful adjunct to occupational hygiene programme. It is more than 1mg/l among those with significant exposure, although these concentrations do not correlate well with the extent of exposure or potential for toxicity. In the absence of clinical signs and symptoms, the presence of beryllium is **not a sign of disease**.

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

At present , laboratory tests are not available to determine susceptibility to beryllium sensitization and the potential to develop clinical examination and baseline data with particular attention to:

- This should include a medical history. Physical examination with particular attention to atopy and allergic skin respiratory diseases.
- Chest X-ray and basic pulmonary function tests (FEV 1, FVC) are also essential.

Atopic subjects & persons with respiratory diseases are considered by some as especially vulnerable.

4.2 PERIODIC MEDICAL EXAMINATION

The tests same as for pre-placement examinations Conducted annually or if exposure is heavy much more frequently

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Full blood count
- Urine
- Lung biopsy
- Beryllium patch test may not be specific.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for suspension and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS:

If the urine level exceeds, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat tests

- ❖ Workers should not have symptoms & signs of disease at the time of return to work.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to Beryllium.

6.3 TREATMENT

In acute berylliosis, contact with beryllium must be discontinued. Since mild symptoms precede a severe attack, the patient must be admitted to the hospital.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work process
- ❑ Workplace hygiene
- ❑ Adequate ventilation, mechanical filter respirator, Pressurized suit in particularly hazardous places, compulsory changing of working clothes, wear chemical goggles, Rubber gloves
- ❑ Appropriate signage

8.0 REFERENCES

1. Baselt RC Biological Monitoring Methods for Industrial Chemicals Biomedical Publications, Davis, California 1980: 47.
2. Beryllium induced lung disease, Criteria for Diagnosis of Occupational Lung Disease Ministry of Health, 1997: 26.
3. Occupational Safety and Health Guideline for Beryllium and its compounds Potential Human Carcinogen. US Dept. of Health and Human Services, CDC, NIOSH 1988.
4. Information Notices on Diagnosis of Occupational Disease for European CommissionL-2920 Luxembourg Office for Official Publications of EU 1994: 1.6.
5. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio. 1987: 155-6.
6. Diseases caused by beryllium and its toxic compounds In Early Recognition of Occupational Diseases World Health Organisation; 1986: 44 -7.

7. CADMIUM AND ANY OF ITS COMPOUND

1.0 Physicochemical properties

Cadmium is a soft, ductile, white metal with a bluish tinge.

PEL 8 hr TWA

Elemental 0.01 mg/m3
Compounds 0.002 mg/m3
(respirable fraction)

Route of absorption

Inhalation, Ingestion (in condition of poor general hygiene).

Non-occupational exposure

Cadmium is widely present in the diet and especially from smoking.

Excretion

Elimination is slow, with half-life of >10 years: it takes place via the kidneys. Cadmium is held in the body to small protein, metallothionein, mostly in the kidneys and liver.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Nickel-cadmium battery manufacturing (tabletting and assembly of Cd electrodes).
- Silver brazing, welding and soldering operations using cadmium-containing fillers.
- Plastics industry, especially compounding of polyvinyl chloride (PVC); used as thermal stabiliser.
- Electroplating. (metallic Cadmium is used)
- Pigment manufacture and use, e.g. for plastics, textile, paper, rubber industries; in inks, enamels & glazes
- Alloy manufacture, e.g. low melting-point brazing alloys, Ag-Cd & Cu-Cd
- Fungicides manufacture and use
- Manufacture of refrigerators, air-conditioners, television picture tubes, semiconductors, photocells & fluorescent lamps, and as neutron absorber in nuclear reactors.
- Jewelry manufacture
- Automobile and aircraft industries
- Smelting and refining of Zn, Pb or Cu ores and scrap processing.

3.0 TOXIC EFFECT

3.1 ACUTE EFFECT

- Chemical pneumonitis following fume inhalation; onset within 8 to 24 hours; mortality 15%. Metal Fume Fever.
- Gastrointestinal tract irritation following accidental ingestion.

3.2 CHRONIC EFFECTS

- Renal dysfunction (tubular or glomerular damage with low molecular weight proteinuria, glucosuria, amino aciduria, albuminuria and reduced creatinine clearance)
- Kidney stones
- Emphysema
- Bone pain (Itai-Itai, Ouch-Ouch Disease), osteomalacia & fractures.
- Anosmia

Note: Cigarette smoking adds to cadmium burden. Each cigarette contains about 1 -2 ug cadmium (Cd) of which approximately 25 -50% is retained in the lungs.

The average normal gastrointestinal absorption in man ranges from 3 -7% of ingested cadmium. This increases to as high as 20% with nutritional deficiencies of calcium, iron or protein.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels > 50 % PEL or where there is significant risk of absorbing cadmium.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
Cadmium in urine	Not critical	5µg/g creatinine
Cadmium in blood	Not critical	5µg / L

Source: TLVs & BEIs ACGIH, 2000

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination & baseline data (for future biologic monitoring) with particular emphasis on the :

- Detailed history of previous diseases and occupational exposures especially lung and renal problems & about previous and present exposure to lung and kidney toxins (tobacco, silica, asbestos, irritant gases, mercury, lead, etc).
- Identification of personal habits (smoking, hygiene, hobbies, alcohol consumption, fingernail biting).
- Complete physical examination
- Respiratory (CXR, Lung Function Tests-FEV 1, VC,V max 50,V max 25 or possibly closing volume
- Olfactory sense .
- Evaluation of the ability of the individual to use respiratory protective devices
- Skeletal system
- Renal system
- Hb, creatinine
- Blood cadmium estimation (venous blood in heparinised container)
- Urine: Cadmium concentration, classic urine analysis, including determination of specific protein concentration i.e.
- Urine Beta2 -microglobulin estimation. DO NOT USE EARLY MORNING SPECIMEN. Collect morning specimen 2 hours after drinking 15 ml. Mist Potassium Citrate. Discard specimen if urine pH lower than 5.6. Keep specimen refrigerated after collection and in ice during transportation.

Specimens should reach the laboratory within 2 hours after collection.

Persons showing signs of lung disturbances and kidney damage should not be exposed to cadmium.

Since teratogenic effects have been produced in animals with high doses of Cd and since Cd appears to accumulate in placenta, it may be preferable to prevent any Cd exposure during pregnancy.

4.2 PERIODIC MEDICAL EXAMINATION

Depending on the risk of overexposure to Cd (based on workplace air monitoring analyses) a medical assessment should be performed at interval of 3 months first year of exposure and at interval of 6 month thereafter. Its purpose is threefold:

(a) Detection of early biological effects of Cd

(b) Detection of excessive exposure to Cd before the occurrence of significant biological effects

(c) Detection of non-occupational related diseases that would justify reduction of Cd exposure.

(d) Blood Cd level

(e) Urine Cd level

(f) Urine test for protein (total) and beta -2 microglobulin)

Periodic-exposure to airborne cadmium oxide fumes

This needs annual consultation with OHD including :

- Questionnaire to elicit respiratory symptoms
- Lung function testing- spirometry
- Chest X-ray

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE:

- Urine cadmium estimation (early morning specimen collected in acid-washed container and corrected to SG of 1.016 or creatinine concentration).
- Urine examination for total protein using the Trichloroacetic acid (TCA) test (To 1 ml urine add l00ul 25% TCA. Mix and read turbidity against protein standards of 10 mg -100 mg/dl); early morning specimen.
- Urine examination for albumin and transferrin, glucose, calcium, phosphates and amino acids and microscopic examination, urine protein electrophoresis.
- Full-size chest x-ray and lung function tests (FEV 1 and FVC)
- Abdominal X-ray (for renal stones) and X-rays of long bones, scapula and pelvis (for osteomalacia and fractures)
- Haemoglobin estimation
- Blood pressure measurement
- Serum creatinine and urea estimation Creatinine clearance estimation.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of suspected cadmium poisoning and excessive absorption.
- All cases of renal dysfunction (tubular or glomerular)
- All cases with abnormal lung function
- Cases with **blood** cadmium levels of more than **15 µg/litre** in 2 successive examinations.
- Cases with **urine** cadmium levels of more than **15 µg/gm** creatinine in 2 successive examinations
- Cases with **urine** Beta2-microglobulin exceeding **300 µg/litre** with creatinine correction. in 2 successive examinations
- All cases with evidence of cancer (lungs)

All cases recommended for removal and suspected cases of cadmium poisoning / excessive absorption or cancer must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

- If the blood cadmium level exceeds 10 µg/litre, a repeat blood cadmium test must be done **immediately** together with a urine cadmium estimation and creatinine clearance test.
- If the urine Beta2-microglobulin result exceeds 300 µg/gm creatinine, a repeat test should be done **one month later.**

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

All suspended cases should have repeat blood and/or urine cadmium and/or urine Beta2-microglobulin examinations, where indicated, at 3-monthly intervals.

- Cases with definite evidence of permanent renal or lung damage or cancer should preferably not continue with cadmium work.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to cadmium.

For return to work with cadmium work the criteria are:

Parameter	Level
Symptoms & signs cadmium Poisoning	Not present
Blood cadmium	<10 µg/litre
Urine cadmium	10 µg/gm creatinine
Urine Beta2 microglobulin	300 µg/gm creatinine

6.3 TREATMENT

All cases of cadmium poisoning must be immediately removed from exposure. Acute poisoning cases must be referred for hospital treatment. **There is no suitable antidote**.

7.0 PREVENTIVE MEASURES

- Improvement in -work process
- Improvement in workplace hygiene (ventilation)
- Use of approved PPE
- Appropriate signage

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Lee HC Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family Medicine, National University of Singapore 1997.

2. Threshold Limit Values (for Chemical Substances and Physical Agents) and Biological Exposure Indices, American College of Government Industrial Hygienists (ACGIH), Cincinnati, Ohio, USA. 1999.

3. National Institute for Occupational Safety and Health: Criteria for a recommended standard. Occupational exposure to cadmium, US Department of Health, Education and Welfare, USA, 1976 (HEW Publication No (NIOSH) 76 -192).

4. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.

5. Friberg L., Piscator M., Nordberg G. F., Kjellstrom T: Cadmium in the environment, edition 2, Cleveland, Ohio, Chemical Rubber Co, 1974.

6. World Health Organisation: Recommended Health Based Limits in Occupational exposure to heavy metals -Report of a WHO Study Group, Technical Report Series 647, 1980.

7. Cadmium and Health: A Toxicological and Epidemiological Appraisal Vol. I and n. 1985.

8. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance-Cadmium in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd. London, 1989: 1/5-1/7.

8. CARBON DISULPHIDE

1. 0 SYNONYMS: Carbon Bisulphide

PEL 8 hr TWA: 10 ppm

Physicochemical properties

Colourless liquid, sweetish aromatic odour. Commercial and reagent grade is a yellowish liquid with a foul smell. It is volatile and flammability, boiling point, melting point and its vapours are explosive. Often with offensive rotten cabbage odour.

Route of absorption

Inhalation & dermal

Mode of toxic action

1. Enzyme inhibition via sulfhydryl groups
2. Proliferation of vascular endothelium producing general arteriosclerosis
3. Fatty degeneration of liver, Glomerulosclerosis, CNS depression. Optic neuritis.

Metabolism and Excretion

A variable portion (10-30 %) is exhaled unchanged, the majority is metabolised. Three major metabolites appear in urine

of which 2-thiothiazolidine-4-carboxylic acid (TTCA) accounts for 6 % of absorbed dose.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

Adhesives, Chemical synthesis, Disinfectant, Extraction, Solvent in laboratories and industrial processes, Insecticides, Herbicides, Lacquers and varnishes, Perfumes, in Viscose Rayon industry as a solvent of alkaline cellulose, resins, rubber.

3.0 TOXIC EFFECTS

General: Extremely Toxic Potent neurotoxin

3.1 ACUTE EFFECT

General	Headache, dizziness, nausea, vomiting, abdominal pains
Skin	Vesicant action on skin, flushing of skin
CNS	Narcosis, behaviour disorders, hallucinations, delirium, progressive paralysis and death due to respiratory paralysis
Eyes	Irritant, keratitis and Conjunctivitis

3.2 CHRONIC EFFECTS: After 10 - 15 years

Long term: Low exposure results in mental and neurological problem

Prolong exposure: At high concentration cause damage to many body systems.

General	Headache Dizziness
CNS	Encephalopathy, Parkinsonism. Deafness
Psychiatric	Emotional disturbance and psychosis
Eyes	Central scotoma, Concentric contraction of colour, Field Disturbed stereoscopic vision, blindness
Peripheral nervous system	Polyneuritis: Motor & sensory nerves of lower extremities, Loss of sensation & weakness of extremities, paralysis
Heart	Increases fat levels and leading to arteriosclerosis heart attacks & poor circulation in extremities. Cardiomyopathy
Gastro-Intestinal	Anorexia, chronic gastritis, decrease free HCL, hepatotoxic, GIT dysfunction
Genito-urinary:	Microhematurias, albuminuria, hypertensive nephrosclerosis
Endocrine	Reduced adrenal function due to reduced secretion of corticotrophins

Reproducti-ve	In woman Hormonal disturbance, menstrual irregularities, spontaneous abortions & premature deliveries
	In Man: impaired spermatogenesis

i. Iodine Azide Test
   Positive: if exposure level > 50 mg CS2/m3
   Negative; if <50 mg CS2/m3
ii. Measurement of Carbon Disulphide
iii. DTS

Air concentration of CS2 and effects on man

Air concentration of CS2 mg/m 3	Effects
10-60	Physiological disturbances
At exposure levels > **50**	The iodine -azide test **reflects exposure**
60-90	Psychological symptoms
30-125	Vascular effects

Source: WHO Early Recognition of Occupational Diseases Geneva.1986

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
2-Thiothiazolidine-4-carboylic acid in urine (TTCA)	End of shift	**5mg /g creati-nine**

Source : TLVs & BEIs ACGIH 2000

Biological Monitoring with Effect

i. Neurophysiological changes EMG and nerve conduction study.
   Finding - Reduced in conduction.
ii. Neurobehavioral change from heavy psychiatric and neurological symptomatology

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the -in-air standard, and or where there is significant risk of absorbing it.

Biological Monitoring and exposure

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data condition with special attention to :

- Cardiovascular systems.
- Nervous system and

- ♦ Exercise ECG- to detect early evidence of heart disease
- ♦ Serum high density lipoprotein cholesterol
- ♦ Opthalmoscopy

4.2 PERIODIC MEDICAL EXAMINATIONS

These should be carried out once a year. Medical element including

- ♦ **Psychological testing** to aid early detection of behaviour disorders
- ♦ **Measurement of nerve conduction velocities** to detect sub-clinical peripheral neuropathy
- ♦ **Colour vision testing-** colour discrimination is reported in exposed workers.

4.3 OTHER INVESTIGATIONS

- ♦ Liver function test
- ♦ Adrenal function test
- ♦ Urine analysis

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ♦ All cases of definite or suspected poisoning and excessive absorption

All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS:

Confirm suspected abnormality.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine examinations (relevant biochemical tests where indicated) at **(3-monthly** intervals if required) and should not return to work until the urine / blood level falls **below 5mg /g creatinine** and symptoms and abnormal biochemical results have disappeared.

- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to chemical hazardous to health.

6.3 TREATMENT

First Aid.

Irrigate eyes with water.

Wash contaminated areas of body with soap and water.

7.O PREVENTIVE MEASURES

- ❑ Adequate ventilation
- ❑ Approved PPE - Suitable goggles, rubber gloves, and chemical cartridge respirator.
- ❑ Prohibited for the cleaning and degreasing purposes
- ❑ Appropriate signage.

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1997.
2. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio. 1987: 86-8.
3. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
4. Early Recognition of Occupational Diseases, WHO Geneva 1986: 97.
5. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11- Health Surveillance- Carbon Disulphide in The Health and Safety Factbook Health & safety Executive , Professional Publishing Ltd London,1989:1/8.
6. Information on the Prohibition of Substances from Certain purposes. DOSH,1999:5.

9. DISULPHUR DICHLORIDE

1.0 SYNONYMS : None

Route of Absorption

Inhalation

Dermal

Confirmed carcinogen (IARC 1) Bladder tumours

2.0 OCCUPATIONS INVOLVING RISK OF EXPOSURE

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

3.2 CHRONIC EFFECTS

Bladder tumours

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to airborne levels and are liable to inhale it or where there is significant risk of absorbing it.

Please refer to the recommended guidelines for bladder cancer screening as in page 14.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular attention to:

- Kidneys
- Neurological
- Respiratory system.

4.2 PERIODIC MEDICAL EXAMINATIONS

As for Pre-employment

- Urine cytology to be done annually but if exposure is high carry it out more frequently.
- Bladder cystoscopy if indicated.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning or disease and excessive absorption.

  All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If abnormal symptoms & signs persist, a repeat test must be done immediately.

Refer to urologist for abnormal urine cytology.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat investigation urine examinations and relevant biochemical tests where indicated and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to disulphur dichloride.

6.3 TREATMENT

All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.

Wash contaminated areas of body with soap and water.

7.0 PREVENTIVE MEASURES

- Improvement in work-process & workplace hygiene
- Adequate ventilation
- Approved Protective equipment
- Chemical goggles
- Appropriate signage

8.0 REFERENCES

1. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.

10. BENZENE INCLUDING BENZOL

1.0 SYNONYMS

Benzol (crude benzene)**, Benzole, Benzonine, Phenyl Hydrate, Bicarbonate of Hydrogen, Cold Naphta**

It is a an aromatic hydrocarbon & is a natural component of crude and refined petroleum

PEL 8 hr TWA: 0.5 ppm

Physicochemical Properties

Colorless, volatile, with sweet aromatic odour.

Route of entry

Inhalation
Skin
Ingestion

Crosses the placenta

Excretion

Metabolism is the main route: about 12% is exhaled unchanged with the triphasic pattern

(Half-lives of 25 mins, 2.5 hours and 30 hours)

One third of the absorbed dose appears rapidly in urine having been metabolised to phenols.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Petrochemical industries e.g. manufacture of benzene, production of carbon black
- Petroleum refineries
- Is a constituent of gasoline
- Re-bottled gasoline sellers.
- Used as a solvent in manufacture of plastics, synthetic fibers, detergents, synthetic resins
- Laboratories e.g. use of benzene in analytical techniques, is a solvent for fats
- Work involving use of commercial solvents such as toluene and xylene (**Benzene may be present as a contaminant)**
- In glue used in shoe manufacture
- Used as a solvent in paint stripping
- Used in carburetor cleaning purposes.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS (500-1000 ppm)

Narcosis, nausea, tremors, unconsciousness, death.

Levels of 20,000 are fatal to humans within 5-10 min.

Skin and mucous membrane irritation

3.2 CHRONIC EFFECTS

- Non-specific manifestations e.g. anorexia, headache, dizziness
- Bone marrow depression (Levels of 100-500 ppm)
- Leucopoenia, thrombocytopenia, anaemia, pancytopaenia aplastic anaemia
- Skin irritation (repeated skin contact) dry, scaly dermatitis erythema and/or blistering
- Nervous system-inflammation of nerves
- Ventricular Arrhythmia

Others conditions

It is a known human carcinogen (ACGIH A1)

- Acute myeloid Leukemia (most common being acute myeloid leukemia)
- Lymphoma
- Multiple myeloma

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any occupational exposure to benzene & benzol

4.1 PRE-PLACEMNT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular emphasis on the hematological and central nervous systems.

General

- Haemoglobin and full blood count (total white blood cells, red blood

cells and platelets, especially for those who are exposed to high levels of benzene

Specific

- Full blood Picture & Peripheral blood film (to look also for blast cells)
- **Urinary phenol estimation**

  It is a useful indicator for monitoring workers exposure (if diet is carefully controlled for phenol products)

A spot urine phenol **> 20 mg/L** suggests occupational exposure.

4.2 PERIODIC MEDICAL EXAMINATIONS

Annual, but the frequency of test may be increased to 6 monthly (If exposure > TLV- every 6 month) or even 3 monthly intervals if exposure is heavy. The content should be the same as at the pre-placement

- Full blood picture
- Urinary phenol
- Urinary trans-muconic acid and s-phenylmercapturic acid (S-PMA) more sensitive and specific tests for measurement of low levels of benzene exposure.

BIOLOGICAL EXPOSURE DETERMINANT

DETERMIN-ANT	SAMPLING TIME	BEI
Urinary phenol	End of shift	**> 50 mg/L**
S-Phenyl-mercapturic acid in urine (S-PMA)	End of shift	25µg/ creatinine
t, t – Muconic acid in urine	End of shift	500µg/ creatinine

Source: TLVs & BEIs ACGIH, 2000.

4.3 WHERE INDICATED OTHER TESTS MAY BE DONE

- Bone marrow biopsy
- Liver function test

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption
- Cases with urine phenol levels **of more than 50 mg/L**
- (Or 50 mg/g Cr) in 2 successive examinations
- Cases of anemia and/or leukemia

All cases recommended for MRP and suspected cases of benzene poisoning / excessive absorption or cancer must be notified to the DG (DOSH).

6.0 FOLLOW -UP ACTION

6.1 ABNORMAL RESULT

Blood count or peripheral blood film should be referred to exclude effects due to

benzene even if the urine phenol level is below 50 mg/L (or 50 mg/g Cr).

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

All suspended cases should have:

- ❖ Repeat urine phenol estimations at monthly intervals
- ❖ The worker may return to work with benzene when the urine phenol level falls below 50 mg/L (or 50 mg/g Cr) &
- ❖ Haematological results are normal
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to benzene.

7.0 PREVENTIVE MEASURES

- ❑ Young persons under 18 years of age and pregnant/nursing mothers should not be exposed to benzene.
- ❑ Workers with liver disease and/or anemia should not work in areas where there is significant benzene exposure.
- ❑ Workers should not smoke as smoke from one cigarette contains 60-80 µg of benzene: a typical smoker inhales 1-2 mg of benzene daily. This may confound low-level benzene exposures.
- ❑ Benzene is prohibited for cleaning & degreasing purposes in Malaysia.

8.0 REFERENCES

1 Phoon WH, Magdalene Chan, Ho SF, Lee HC Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family Medicine, National University of Singapore 1997:6.3.1-4.

2 International Labour Office: Encyclopaedia of Occupational Health

and Safety, Geneva, 3rd edition Volume 1, 1983: 257-61.

3 National Institute for Occupational Safety and Health: Criteria for a Recommended Standard Occupational exposure to Benzene, US Department of Health, Education and Welfare 1974: 74-137.

4 Robert R. Lawerys: Industrial Chemical Exposure Guidelines for Biological Monitoring, 1983: 47-54.

5 Richard S. Brief et al: Benzene in the Workplace. Am Ind. Hyg. Assoc., Vo141, 1980:616-623.

6 Threshold Limit Values (for Chemical Substances and Physical Agents) and Biological Exposure Indices, American College of Government Industrial Hygienists (ACGIH), Cincinnati, Ohio, USA, 1999.

7 Swaen GMH and Meijer *IMM:* Risk Assessment of Leukaemia and Occupational Exposure to Benzene. BJIM; Vol46 No.12: 1989: 826-830.

8 Guidelines for health surveillance for benzene NOHSC: 7039(1995). Jan 1996.

9 Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance-benzene in The Health and Safety Factbook Health & Safety Executive, Professional Publishing Ltd London, 1989-1/7.

10 A Buchwald – Benzene in Poisoning & Drug overdose Olson KR a Lang clinical manual 1999:104-5.

11 Information on the Prohibition of Substances from Certain Purposes DOSH, 1999:4.

11. CARBON TETRACHLORIDE

1. 0 Synonyms: Perchloromethane, Tetrachloromethane

PEL 8HR TWA: 5 ppm

Physicochemical properties

Heavy colourless, non-flammable liquid
Ether like odour is a poor warning property
Breakdown products include hydrogen chloride, chlorine gas
and phosgene.

Route of Absorption

Inhalation as vapour
Dermal
Ingestion.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

Adhesives, Chemical synthesis, Fire extinguisher
Fumigant, solvent, dry cleaning solvent, degreaser, spot remover.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

General	Headache & Dizziness, nervousness, Irritant to the eye, nose, throat
CNS	Dizzy, unconsciousness and coma, optic neuritis,

	coma, optic neuritis, Neurosis
Lungs	Dyspnoea and cyanosis, Pulmonary oedema
Renal	Kidney: Destruction of renal tubules with nephritic and nephrotic symptoms oliguria, proteinuria, haematuria
Gastro-intestinal	Nausea, vomiting, haematemesis, abnormal cramps and diarrhoea, cardiac muscle depression Liver failure/necrosis - Hepatomegaly & jaundice
Heart	Cardiac muscle depression Ventricular fibrillation & sudden death.
Skin	Dermatitis

3.2 CHRONIC EFFECTS

Apathy and mental confusion, Headaches and dizziness

Fatigue

Anorexia, nausea, vomiting, abdominal pain

Restriction of visual fields and diminished visual acuity

Loss of weight, Jaundice

Dermatitis

Evidence of renal damage

A carcinogen in test animals (IARC 2B)

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the in-air standard, and or where there is significant risk of absorbing it.

4.1 PRE-EMPLOYMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular attention to :

- Carbon tetrachloride in serum, urine and expired air
- Increase in glutamic oxaloacetic transaminase
- Increase BUN
- Urinary urobilinogen elevation occurs after 7-10 days
- GC can be used to analyze expired air
- Urine estimation (early morning specimen corrected to serum creatinine).

Preclude from exposure those individuals with disease of liver, kidneys and central nervous system or alcoholism.

4.2 PERIODIC MEDICAL EXAMINATIONS

In general annual examinations as at the pre-employment check but for exposed personnel **every six months** if exposure is high including studies of :

- Liver (including prothrombin time)
- Kidney function

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ♦ All cases of definite or suspected poisoning and excessive absorption.

All cases with recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

Repeat tests if the urine level exceeds, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ♦ All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the urine/blood level are within normal limits and symptoms and signs have disappeared.
- ♦ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to carbon tetrachloride.

6.3 TREATMENT

- ▪ Irrigate eyes with water
- ▪ Wash contaminated areas of body with soap and water
- ▪ Gastric larvage, if ingested, followed by saline catharsis
- ▪ Oxygen and artificial respiration
- ▪ Refer to hospital

7.0 PREVENTIVE MEASURES

- ❑ Attention should be paid to substituting a less toxic chemical for carbon tetrachloride where possible**.**
- ❑ Adequate ventilation, Chemical goggles, Chemical cartridge respirator, Polyvinyl gloves
- ❑ Avoid alcohol as alcohol abuse increases risk of toxicity
- ❑ Prohibited in the cleaning and degreasing purposes.
- ❑ Appropriate signage.

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1997.
2. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio.1987: 89- 91.
3. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
4. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation 11-Health Surveillance-

Carbon tetrachloride in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989-1/9.

5. Olson KR, Poisoning & Drug overdose a Lang clinical manual 1999:127-129, 449t.

6. Information on the Prohibition of Substances from Certain Purposes. DOSH, 1999:5.

12. TRICHLOROETHYLENE (TCE)

1.0 SYNONYMS: Acetylene trichloride. Trichloroethene

PEL 8 hr TWA : 50ppm

Absorption

It is well absorbed by inhalation: the skin is a possible route.

Excretion

The majority is metabolised. A small proportion is exhaled unchanged. The 2 major urinary metabolites are trichloroacetic acid and trichloroethanol.

Non-occupational exposure TCE May be present in a few household solvents e.g. spot removers.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Workers involved in vapour degreasing and cold cleaning of metal parts in metal fabricating, automotive, aircraft and aerospace industries.
- Used for cleaning of lenses in optical industry.
- Used as solvent for extraction of waxes, fats, resins and oils.
- Used as a solvent or chemical intermediate in printing inks, varnishes, adhesives, plaints,

lacquers, rug cleaners and disinfectants.

3.0 TOXIC EFFECT

3.1 ACUTE EFFECTS

Nervous system- narcosis, headache, dizziness, nausea, lack of co-ordination, mood changes (Addictive potential). Massive exposure can cause excitation and euphoria, sleepiness and coma.

Mucosa Membranes:

Irritation of eye, nose, throat and respiratory tract.

Respiratory System:

Chemical pneumonitis and death from respiratory failure can occur.

Heart:

High exposure level can sensitise myocardium and cause cardiac arrhythmia and death from cardiac failure.

3.2 CHRONIC EFFECTS

Central Nervous System:

Non-specific complaints like headache, irritability, fatigue and insomnia. Psychological disorders. Mood changes, poor memory impairment in psychomotor and behavioral tests have been reported.

Alcohol intolerance characterised by skin vasodilatation especially in the face can occur.

Neuropathy: loss of function of nerves

Liver

Few cases of hepatitis-like syndromes and statuses (fatty liver) have been reported from chronic exposure to trichoroethylene.

Skin

Prolonged or repeated skin contact with liquid TCE can cause irritation and dermatitis.

Kidney

Altered renal function such as proteinuria and raised blood urea may occur.

Others

Severe systemic allergic reaction may occur in sensitive individuals with minimal TCE exposure

Note: **When there is mixed exposure to perchloroethylene or and other solvents, there may be combined effects on target organs.**

4.0 MEDICAL SURVEILLANCE PRGRAMME

Any work where workers are exposed to air levels of trichloroethylene which are liable to exceed 10% of the permissible exposure level and/or where there is a risk of skin contact.

Alcohol intake should be recorded.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with emphasis on the:

- Central nervous system
- Liver

- Skin and
- Kidney

INVESTIGATIONS

- Mid-week end-of-shift urinary trichloroacetic acid (TCA) determination (results to be corrected for specific gravity or urinary creatinine concentration).
- Liver function tests (serum bilirubin, alkaline phosphatase, aspartate aminotransaminase, alanine aminotransferase and gamma glutamyl transferase).

Workers with liver diseases, solvent abuse or who are alcoholics should not work in areas where there is significant TCE exposure.

4.2 PERIODIC MEDICAL EXAMINATIONS

Should be similar to pre-placement examination. An annual check is appropriate.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling Time	BEI
Trichloroacetic acid in urine	End of workweek	100mg/g creatinie
Trichloroacetic acid & trichloroethanol in urine	End of shift at end workweek	300mg/g creatinine
Free trichloroethanol in blood	End of shift at end workweek	4mg/L
Trichloro-ethylene in blood		
Trichloro-ethylene in end-exhaled air		

Source: TLVs & BEIs ACGIH 2000

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Liver function tests

Note:

- **Workers should abstain from alcohol one week prior to urine collection**
- **Workers on Phenobarbital and chloral hydrate treatment may have increased urinary TCA.**

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected TCE poisoning and excessive absorption of TCE.
- Cases with urinary TCA of more than 100 mg/l in 2 successive examination;
- Workers with persistently abnormal liver function test results.

- ❖ Workers presenting with fever and skin rash. They should be investigated to exclude TCE allergy.

***Note:**

Where there is mixed exposure to TCE and perchloroethylene (PCE), a BTLV of 50 mg/l should be adopted if the air level for PCE is less than half PEL. Where the air level for PCE is more than half PEL, a BTL V of 7 mg/l should be adopted.

All cases recommended for MRP and suspected cases of disease and poisoning must be notified to DG of DOSH.

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

If urinary trichloroacetic acid (TCA) level is 100 mg/l or more, repeat test immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All cases with excessive TCE absorption should have a repeat urine TCA level fortnightly. The worker may return to work if urine TCA level falls below 100 mg/l.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to TCE.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work-process & workplace hygiene
- ❑ Adequate ventilation, Approved Personal Protective Equipment Chemical goggles
- ❑ Appropriate signage

8.0 REFERENCES

1. National Institute for Occupational Safety and Health: Criteria for a Recommended Standard. . Occupational exposure to trichloroethylene. US Department of Health, Education and Welfare, USA, (HSM-99-72-129), 1973.
2. WHO: Environmental Health Criteria 50- Trichloroethylene, Geneva 1985.
3. American Conference of Governmental Industrial Hygienists: Documentation of Threshold Limit Values and Biological Exposure Indices, Cincinnati, 1999.
4. Hiroka Nakayama; et al: Generalized Eruption With Severe Liver Dysfunctional Associated With Occupational Exposure to Trichloroetllylene. Contact Dermatitis, 19; 1988: 48-51.
5. R J McCunney: Diverse Manifestations Of Trichloroethylene. British Journal of Industrial Medicine, 45, 1988: 122-26.
6. Masana Ogata et al: Biological Monitoring VII: Occupational Exposures to Mixtures of Industrial

Chemicals. Appl Occup Environ Hyg, 8(7),1993: 609-17.

7. Kazunori Sreiju; et al: Dose-Excretion Relationship in Tetrachloroethylene-Exposed Workers and the Effect of Tetrachloroethylene Co-exposure on Trichloethylene Metabolism. Am J Ind Med 16: 1989:67584.

8. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1997.

9. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation 11-Health Surveillance-Trichloroetylene in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989:1/10.

13. n-HEXANE

1.0 SYNONYMS: Hexylhydride, skellysolve

Physicochemical properties

Colourless flammable liquid, highly volatile

PEL 8hr TWA : 50 ppm

Mechanism of action

Irritant. Depressant for central nervous

Route of Absorption

It is readily absorbed by all routes but in industry

Inhalation & dermal routes dominates.

Readily soluble in fat. About15-20% of hexane is taken up by the lungs

Non-occupational exposure

N-hexane may be present in glues or other household solvent mixtures

Excretion

50-60% of absorbed dose is exhaled unchanged, in a biphasic pattern with a half-life of 14 minutes and 2.5 hours. One third of absorbed dose is metabolised and rapidly excreted in the urine.

Metabolism proceeds via methyl butyl ketone to 2,5-hexanedione, the agent responsible for the neurotoxic action of hexane and methyl butyl ketone.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical synthesis
- Fuel. Lubricant

- Solvent in glue used in shoe making

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Conjunctivitis, Defatting dermatitis, Dizziness.
- **Nervous system**- narcosis, dizziness, Ataxia,
  In coordination.
- Peripheral neuropathy has been reported.
- Anorexia and nausea**,** irritation.

3.2 CHRONIC EFFECTS

- Nervous system-neuropathy, weakness & loss of sensation at extremities.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the -in-air standard, and or where there is significant risk of ingesting it.
This is directed at the avoidance of neuropathy from chronic poisoning

4.1 PRE PLACEMENT EXAMINATIONS

Clinical examination and baseline with particular attention to:

- ♦ Kidneys
- ♦ Neurological and
- ♦ Respiratory system.

Urine estimation (early morning specimen corrected for creatinine.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling Time	BEI
2,5 Hexanedione in urine	End of shift	5 mg/g creatinine
n-Hexane in end exhaled air	End of shift	144 mg/m3

Source: TLVs & BEIs ACGIH 2000.

Blood or alveolar air n-hexane and urinary metbolites all may be used in biological monitoring .
Urinary 2,5 Hexanedione seems to be most applicable for routine monitoring, especially because this metabolite is linked to the neurotoxic effect of hexane.

An 8 hr exposure to 50 ppm has, in different studies , resulted in about 2 to 6 mg/L (20-50 μmol / L of 2,5 Hexanedione in post-shift.

4.2 PERIODIC MEDICAL EXAMINATIONS

This should have a similar content to the pre-employment examination. A frequency of once or twice a year is appropriate
Additional elements may include:

1. **Psychological testing**
2. Testing of nerve function by recording conduction velocities

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.
- All cases recommended for MRP and suspected cases of disease, poisoning and excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

- Repeat tests.

6.1 ABNORMAL RESULTS

- If the urine symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to hexane.

6.3 TREATMENT

- Irrigate eyes with water
- Wash contaminated areas of body with soap and water
- Symptomatic and supportive
- Appropriate signage

7.0 PREVENTIVE MEASURES

- Adequate ventilation
- Personal Protective equipment
- Chemical goggles
- Chemical cartridge respirator
- Rubber gloves
- Prohibited in the cleaning and degreasing purposes.

8.0 REFERENCES

1. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance- n-Hexane in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London 1989:1/11.

2. Plukett ER Handbook of Industrial Toxicology Heyden 1987: 208-9.

3. American Conference of Governmental Industrial Hygienist: Documentation of the Threshold Limit Values and Biological Exposures Indices, Cincinnati 2000.

4. Information on the Prohibition of Substances from Certain purposes. DOSH, 1999:5.

14. BIS (CHLOROMETHYL) ETHER BCME

1.0 Synonyms: BCME

Physicochemical properties

Colourless, highly volatile liquid with suffocating odour

TLV 0

Route of entry

Inhalation

Most potent Carcinogen-and is no longer used in chemical industry in USA.

2.0 OCCUPATIONS AT RISK OF EXPOSURE TO BCME

- Used in Chemical synthesis (as organic solvent)
- Manufacture of ion exchange resin

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Irritation of eye & respiratory tract
- Sore throat, Fever.

3.2 CHRONIC EFFECTS

- Cough, chest pains, loss of weight.
- Oat cell & small cell carcinoma.

  A human and animal Carcinogen (IARC 1)

4.0 MEDICAL SURVEILLANCE PROGRAMMME

Any work where workers are exposed to levels of airborne levels and which are liable absorbed or where there is significant risk of ingesting it.

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data with particular attention to lung cancer

- Chest X-rays

4.2 PERIODIC MEDICAL EXAMIANTION

- Annual examination

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Full blood count
- Sputum cytology
- Chest X- Ray after 3 years of exposure

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests if abnormality is detected in history, physical examination and investigations.

6.1 ABNORMAL RESULTS

If the CXR, sputum cytology exceeds, a repeat test must be done immediately.
Refer to chest physician.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat tests
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to BCME.

7.0 PREVENTIVE MEASURES

- Adequate ventilation
- Closed systems
- Chemical cartridge respirator, House keeping, personal cleanliness
- Appropriate signage

8.0 REFERENCES

1. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio. 1987: 58-9.
2. Rom MN Environmental and Occupational Medicine 2nd Edition .Pg Little, Brown& Co. Boston/Toronto/London 1992: 854,941,1025,1379.
3. Olson KR, Poisoning & Drug overdose a Lang clinical manual 1999:452.

15 & 16. CHROMIUM METAL AND ITS COMPOUNDS

(Including chromate or dichromate of potassium, sodium, ammonium or zinc chromic acid)

1. 0 SYNONYMS: Chromic acid, Chromic Sulphate, Chromium trioxide, Potassium dichloromate dihydrate.

Physicochemical properties

Hard, silvery-grey metal, compounds are various colour.

Route of entry

Inhalation
Dermal
Ingestion.

Mode of action

Irritant, Corrosive, Sensitiser.

Hexavalent salts are most toxic

Carcinogenic salts are most toxic. Carcinogenic factor seems to be related to the manufacture of dichromates from the ore (Calcium chromate**).**

2.0 OCCUPATIONS AT RISK OF EXPOSURE

Antioxidants, Batteries, Cement, Chrome plating, pigment (yellow), Refectories, Steel alloys, welding and wood preservatives**.**

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

Skin	Sensitising dermatitis, Chrome hole- skin ulcers
Eye	Conjunctivitis
Gastro Intestinal	Anorexia, nausea, hypertrophic gastritis, Duodenal ulcer, colitis

Upper respiratory tract	Irritate respiratory tract, Perforation of nasal system, Nasal polyps, Epistaxis, sinusitis, laryngitis, anosmia
Lungs	Chest pain, dyspnoea, Pulmonary oedema
Renal	Acute renal tubular necrosis

3.2 CHRONIC EFFECTS

The latent period may be 20years.

Skin	Chrome ulcers- deep ulcers where chromate are deposited on the skin sand not washed off.
Lung	Bronchitis, chemical pneumonitis, chromitosis (pneumoconiosis), bronchogenic carcinoma of lung, Nasal septum perforation. Usually symptomless

Chrome ulcers- deep ulcers where chromates are deposited on the skin sand not washed off.

Lung cancer (Hexavalent chromium)

0

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the -in-air standard, and or where there is significant risk of ingesting it.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
Chromium (IV) Water soluble Fume Total Chromium in urine	Increase during shift	10µg /g creatinine
	End of shift or end of workweek	30µg /g creatinine

Source: TLVs & BEIs ACGIH 2000

Diagnostic criteria / investigation

- Chromium in blood and urine
- Patch test with 0.5% dichromate

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular attention to:

- Detect pre-existing allergies
- Lung disease
- Skin diseases (by means of a questionnaire),
- Urine estimation (early morning specimen corrected to creatinine clearance)

4.2 PERIODIC MEDICAL EXAMINATIONS

Annual examinations as at the pre-placement check are appropriate including looking for nasal septum perforation

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

Annual physical examination of exposed personnel including

- Chest x-ray

- ♦ Pulmonary function test, FEV and FVC.
- ♦ Papanicolaou studies of the sputum at periodic intervals for those at high risk jobs.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION & RETURN TO WORK

- ♦ All cases of definite, suspected poisoning and excessive absorption. (e.g. skin lesions) of chromium or its compounds.

All cases recommended for MRP, suspected cases of poisoning and excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Annual physical examination of exposed personnel including

- ❖ Chest x-ray,
- ❖ Pulmonary function test: FEV1 and FVC

6.1 ABNORMAL RESULTS

If the urine level exceeds, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER AND RETURN TO WORK

- ❖ Must be followed up regularly.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to chromium metal and it compounds.

6.3 TREATMENT

- **First Aid:** All cases of poisoning must be immediately removed from exposure and must be referred for hospital treatment.
- Irrigate eyes with water.
- Wash contaminated areas of body with soap and water.
- **Dermatitis**: Antihistamines, cortisone locally
- **Skin ulcers**: Apply 10% edathamil calcium disodium in lanolin base to ulcer, bandage for 24 hours, curette base and repeated as necessary, Edathamil calcium disodium has been suggested, Symptomatic and supportive.

7.0 PREVENTIVE MEASURES

- ❑ Adequate ventilation, and regular monitoring of the work environment, mechanical filter respirator, chemical goggles, rubber gloves, aprons, boots.
- ❑ No eating or smoking in work area
- ❑ Apply Vaseline or paraffin to nose before going to work
- ❑ Appropriate signage

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines

For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1995.

2. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio. 1987: 86-8.

3. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.

4. American Conference of Governmental Industrial Hygienist: Documentation of the Threshold Limit Values and Biological Exposures Indices, Cincinnati 2000.

5. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation 11-Health Surveillance-Chromium in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989-1/9.

17. FREE CRYSTALLINE SILICA

1.0 SYNONYM: Silicon dioxide, cristobalite,
quartz, tryidymite

PEL 8hr TWA Silica, Crystalline

Cristabalite	0.05 mg/m3
Quartz	0.05 mg/m3
Tridymite	0.05 mg/m3
Tripoli	0.1 mg/m3 of contained respirable quartz

Physicochemical properties

Depends on the content of silica and size and whether respirable or not.

Route of entry

Inhalation

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Mining, quarrying and tunneling of siliceous rocks (e.g. granite, sandstone, slate, mica, silica containing coal or metal ores)
- Rubber milling (using calcium carbonate containing silica)
- Foundries (mould breaking & fettling)
- Abrasive blasting using siliceous grains (e.g. sandstone, sand, quartzite & flint)
- Manufacture of ceramics (chinaware, porcelain, earthenware) and refractories
- Maintenance & repair of refractories (furnace linings);
- Stone cutting, dressing, polishing, cleaning & monumental masonry (including tombstone engraving) using granite & sandstone.
- Enameling using quartz, feldspar, metal oxides and carbonates
- Manufacture of abrasive soaps

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

Silicosis - rare

- due to inhalation of high concentrations of very fine free silica dust particles (e.g. manufacture of abrasive soaps, tunnelling & sandblasting)
- may develop within a few months with severe dyspnoea, cough, mucoid sputum, fever, weight loss & cyanosis
- fatal within a year

3.2 CHRONIC EFFECTS

Silicosis

- Most of the cases are asymptomatic
- Some may have dyspnoea, cough & wheezing

Note:

- Silica is silicon dioxide (SiO2); also called "crystalline" silica. Includes quartz, tridymite and cristobalite
- Silicotics may develop progressive massive fibrosis
- Silicotics are more prone to developing pulmonary tuberculosis They may also have a higher risk of lung cancer .
- There is also an association with scleroderma and chronic renal disease

4.0 MEDICAL SURVEILLANCE PROGRAMME

Please refer to the Factories and Machinery (Mineral Dust) Regulations 1989.

Any work where workers are exposed to levels of airborne free silica which are liable to exceed 50% of the permissible exposure level.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular emphasis on:

- Chest and pulmonary function test, including testing of forced vital capacity (FVC) & forced expiratory volume at one second (FVC1).
- Full size chest x-ray examination. A chest x-ray (posterior-anterior, 350 mm by 430mm).
- A statement of the medical, occupational and smoking history of the person examined.
- Detailed examination for tuberculosis.
- Any laboratory or other test for which in the opinion of OHD.

Examination of the chest even in advanced cases may reveal little abnormality

4.2 PERIODIC MEDICAL EXAMINATIONS

Conducted annually. Tests may be the same as pre-placement but will depend on the exposure levels and symptoms and signs of disease and poisoning.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE:

- Lung function test e.g. forced vital capacity (FVC) and forced expiratory volume in one second (FEV1).

- Sputum examination for acid fast bacilli.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

It is not necessary to suspend all cases with silicosis. The following should be considered for permanent suspension:

- Cases with definite evidence of silicosis aged below 35 years and who are symptomatic (e.g. with pulmonary tuberculosis, chronic bronchitis or cardiac failure).
- Cases with pulmonary tuberculosis and other cardio-respiratory diseases.

All cases recommended for suspension and suspected cases of silicosis must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

All suspected cases of silicosis (category 1/0*) should have a repeat full-size chest x-ray and clinical examination after one year (or earlier if symptomatic).

Cases of definite silicosis (category 1/1 * and above, consistent in 2 consecutive films) should be followed up annually with a full size chest x -ray and clinical examination to exclude complications (e.g. pulmonary tuberculosis, chronic bronchitis and cardiac failure).

6.2 MEDICALLY REMOVED CASES & RETURN TO WORK

- All suspended silicosis cases should be followed up annually or more frequently to exclude complications.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to silica.

Note: *The chest radiographs should be compared with the set of standard films of ILO 1980 Classification of Radiographic appearances of the Pneumoconiosis (Reference 4)

6.3 TREATMENT

- There is no definite treatment for silicosis, thus prevention should be emphasized.
- All pulmonary tuberculosis cases should be referred for further management in a chest hospital/clinic.
- Symptomatic silicotic cases may require treatment as and when indicated.

7.0 PREVENTIVE MEASURES

- As there is no cure for silicosis preventive measures are essential.
- Workers should not smoke, as tuberculosis is associated with silicosis.
- Use approved PPE
- Appropriate signage

8.0 REFERENCES

1. Factories and Machinery (Mineral Dust) Regulations 1989.

2. National Institute for Occupational Safety and Health: Criteria for a Recommended Standard. Occupational Exposure to Crystalline Silica. US Department of Health, Education, and Welfare, USA 1974. (HEW Publication No (NIOSH) 75-120).

3. Vigliani EC: Silicosis In: Encyclopaedia of Occupational Health and Safety, International Labour Office: Geneva, 3rd edition 1983: 2037-41.

4. International Labour Office: ILO *U/C* International Classification of Radiographs of Pneumoconiosis, Occupational Safety and Health Series 22 (rev), Geneva, 1980.

5. World Health Organisation: Pneumoconiosis In: Early detection of occupational diseases, Geneva, 1986: 9-25.

6. Davis GS: Silica In: Occupational and Environmental Respiratory Disease, Harber P, Schenker MB, Balmes JR, editors, Mosby-Year Book, 1996: 373-99.

7. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance-Lung diseases due to dusts: pneumoconiosis in The Health and Safety Fact book Health & safety Executive, Professional Publishing Ltd London, 1989:1/11.

8. Criteria for diagnosis of occupational lung disease, Ministry of Health 1997:8-9.

PEL 8 hr TWA

Methylene bisphenyl isocyanate (MDI) 0.005 ppm

Methyl isocyanate (MIC) 0.02 ppm

Toluene-2, 4-diisocyanate (TDI) 0.005 ppm

Route of absorption

Inhalation

Percutaneous

18. ISOCYANATES

1.0 SYNONYMS:

4,4' Diphenylmethane diisocyanate (MDI)

Hexamethylene diisocyanate (HDI).

Methyl isocyanate (MIC).

Methylene diisocyante (MDI)

I, 5Naphthalene diisocyanate (NDI)

Toluene diisocyanate (TDI) and many others

Physiochemical Properties

Liquids and Solids

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Foam resins
- Plastic coatings
- Synthetic rubber
- Varnishes and lacquers

3.0 TOXIC EFFECTS

Symptoms and signs

- Severe irritation of eyes, dehydration of tissues, and corneal damage.
- Irritation of skin and burns; darkening and hardening may occur after repeated exposures. Corrosive.
- Angioneurotic edema. Irritation of pharynx. Dyspnea. Headache. Cough. Chest tightness. Asthma
- Recognised by cough, wheeze, shortness of breath. This may develop at exposure to levels below those causing irritation.
- Once sensitisation has developed, very low levels of exposure will produce symptoms. Bronchitis.
- Pulmonary edema.

- Nausea and vomiting

3.1 ACUTE EFFECTS

- **Irritation, sensitization**
- Skin & upper respiratory tract toxicity.
- Burning of eyes and skin, cough and wheezing are common.
- Non-cardiogenic pulmonary oedema may occur.
- Symptoms may occur immediately with exposure or may occasionally be delayed by several hours.

3.2 CHRONIC EFFECTS

- Chronic exposure may cause lung fibrosis and fall in lung function.
- Eosinophilia may occur.

Disability:

- Sensitization may be permanent.
- Respiratory changes can be permanent.

4.0 MEDICAL SURVEILLANCE PROGRAMME

There are no specific blood or urine tests for isocyanates.

Isocyanate antibody testing although useful epidemiologically, is difficult to interpret in an individual.

4.1 PRE-PLACEMENT EXAMINATIONS

Clinical examination and baseline data with particular attention to identify those with pre-existing disease and to establish baseline records of fitness. This includes consultation with the OHD with particular reference to:

- ♦ Respiratory systems
- ♦ Kidneys

Further tests include:

1. Clinical examination of the chest
2. Pulmonary function testing- Spirometry
3. Chest X-ray

Relative contraindications i.e. conditions likely to be regarded as **rendering those with them less fit for exposure to isocyanates** are:

- Hay fever, recurrent bronchitis, asthma, chronic pre-existing lung disease.
- Some types of eczema.
- Poor lung function test (i.e. man with FEV1 1 litre or more below normal or woman with FEV1 0.8 litre or more below normal.

4.2 PERIODIC MEDICAL EXAMINATIONS

- ♦ Tests of lung function at intervals after start of exposure:2 weeks, 6 weeks and 6 months and at 6-monthly intervals thereafter.
- ♦ Physical examination of exposed personnel annually including chest X-rays, FEV 1 and FVC.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ♦ All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning/excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Establish the diagnosis, if confirmed, suitability to continue the work has to be reviewed.

6.1 ABNORMAL RESULTS

If the symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat clinical examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to isocyanates.

6.3 TREATMENT

First Aid

- Irrigate eyes with water
- Wash contaminated areas of body with isopropyl alcohol and then with soap and water
- Treat skin burns in the usual manner
- Maintain open airways, oxygen, if required
- Bronchodilators, Symptomatic and supportive

7.0 PREVENTIVE MEASURES

- ❑ Adequate ventilation with regular monitoring of work environment
- ❑ Chemical goggles or face shield
- ❑ Chemical cartridge respirator or airline mask
- ❑ Butyl rubber gloves, aprons, and boots
- ❑ No smoking
- ❑ Appropriate signage.

Preclude from exposure those with allergies and chronic diseases of skin, nose, throat and lungs.

Remove from exposure those who become sensitized to isocyanates.

8.0 REFERENCES

1. Hill. R. N. A Controlled Study of Workers Handling Organic Diisocyanates. *Proc. Roy Soc. Med.* 63: 375, 1970.
2. Peters. J. M. et al: Pulmonary Toxicity of Isocyanates. *Ann. Internal Med.* 73: 654,1970.
3. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation 11-Health Surveillance-isocyanine in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989:1/5.

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19. LEAD

(INCLUDING ORGANIC LEAD COMPOUNDS)

19.1 INORGANIC LEAD

1.0 SYNONYMS: Plumbum, Glover

PEL 8hr TWA:

Lead elemental, and inorganic cpds 0.05mg/m3

Lead arsenate as Pb3 (AsO4) 2 0.15 mg/m3

Lead chromate as Pb 0.05 mg/m3
as Cr 0.012 mg/m3

PHYSICOCHEMICAL PROPERTIES

Chemical element: heavy gray, soft, malleable metal.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Manufacture of lead-acid storage batteries (accumulators)
- Manufacture and use of stabilizers in PVC compounding
- Burning/welding/cutting of lead-coated structures e.g. ship-breakers and welders
- Manufacture and use of ammunition e.g. firing range instructors
- Manufacture and use of lead-based paints & solder
- Manufacture and use of glazes for porcelain, enamels, tiles
- Manufacture of alloys

3.0 TOXIC EFFECTS

Hematological:

- Anemia, or a falling hemoglobin level; pallor and fatigability may be present.

Gastrointestinal:

- Mild -anorexia, epigastric discomfort, constipation or diarrhea
- Severe -abdominal colic
- (Burton's line, a bluish-black pigmentation at margins of gums, is an indication of lead exposure, not of lead poisoning)

Peripheral nervous system:

- Paresis (rarely paralysis), often affecting extensors of the hand or foot, with no sensory changes.

Central nervous system:

- Encephalopathy may occur with severe poisoning (drowsiness, convulsions, coma)
- Slow mental changes may occur (learning difficulty, behavioral changes etc have been described in children with lead-exposure)

Renal:

- Chronic nephritis and tubular degeneration may occur

Reproductive:

- Lead can cross the placenta and may cause neurological damage to the foetus (abortion, stillbirths).

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne lead (e.g. dust, fumes) which are liable to exceed 10% of the permissible exposure level, and/or where there is a significant risk of ingesting lead (e.g. handling of lead powders, paste, etc).

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
Lead in **blood**	Not critical	30 µg / 100 ml
Lead in **urine**	Not critical	150 µg /g creatinine

Source: TLVs & BEIs ACGIH 2000

4.1 PRE-PLACEMENT MEDICAL EXAMIANTION

Clinical examination and baseline data with particular emphasis on:

- ♦ Hemoglobin level (g/dL) the hematological and Blood lead level (venous blood in heparinised container)
- ♦ Nervous systems

Where lead poisoning is suspected the following tests may be done:

- ♦ Urinary lead (pre-and-post chelation)
- ♦ Urinary coproporphyrin
- ♦ Electromyograph

4.2 PERIODIC MEDICAL EXAMIANTION

(Every 6 monthly)

1. Blood test for lead level
2. Other relevant biological tests as indicated

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

According to the Factories & Machinery (Lead) Regulations 1984:

Removal is carried out under the following conditions

- ♦ Periodic and a follow up blood sampling test are at or above 80 µgm/100ml of whole blood.
- ♦ The average of the last 3 blood sampling tests conducted indicates that the employees blood level is at or > 73µgm/100ml of whole blood.

- Periodic and a follow up blood sampling test of a females employees of child- bearing capacity indicate that the employees blood level is at or above 40 µgm/100ml of whole blood.
- The result of a medical finding, determination or opinion shows that employee has detected medical condition which increased risk of material impairment to health from exposure to lead.
- A pregnant employee and breast feeding employee from work, which may expose the said employee to lead.

However, for **GOOD OCCUPATIONAL HEALTH PRACTICES THE FOLLOWING SUGGESTIONS SHOULD BE FOLLOWED:**

- All cases of definite or suspected lead poisoning.
- All cases with blood lead levels as follows:

SEX	AGE	Lead levels
Males	All ages	50 µg/l00 ml or more
Females	> 50 yrs	50 µg/l00 ml or more
Females	< 50 yrs	30 µg/l00 ml or more

- Cases of significant anemia: Haemoglobin levels of 10 g/dL or less for females and 11.0 g/ dL or less for males confirmed by an immediate repeat examination

Note: Each laboratory has its own "normal range" for haemoglobin. Haemoglobin levels below the lower limit of this range may be taken as anaemia).

- All pregnant or breastfeeding mothers.

All cases recommended for suspension and suspected cases of lead poisoning must be notified to the DG (DOSH)

6.0 FOLLOW-UP ACTION

Repeat Tests.

6.1 ABNORMAL RESULTS:

- Repeat all abnormal results immediately.
- If the repeat result is still abnormal, refer to the table below.
- A rising blood lead level and/or a falling haemoglobin level in cases where the blood lead level is 50 µg/l00 ml or more should be investigated to exclude poisoning.

Blood lead (mcg/l00 ml)	**Haemoglobin**		
	Normal	Mild anaemia	Signifi-cant anaemia
Males (all ages) and females > 50 yrs			
< 50	No Action	Review	Sus-pend
>50*	Suspend + Notify	Suspend + Notify	Sus-pend + Notify

Female < 50 yrs			
< 30	No action	Review	Sus-pend
> 30**	Suspend + Notify	Suspend + Notify	Sus-pend + Notify

Source: Guidelines for Designated Factories Doctor, Singapore.

Review:

- Investigate cause of anemia.
- Repeat hemoglobin level in 3 months

Suspended cases

Inform the DG (DOSH), the management and the worker using the Certificate of Medical Removal Protection.

- Follow-up at monthly intervals.
- Investigate the cause of the anaemia and/ or the high blood lead levels.

Notify: Notify the DG (DOSH)

*May return to lead work if level is below 40 µg/l00 ml

**May return to lead work if level is below 25 Note: µg/100 ml

6.2 MEDICALLY REMOVED WORKERS AND RETURN TO WORK

According to the FM (Lead) Regulations 1984

Return to work is carried out under the following conditions:

- Two consecutive blood sampling tests indicates that employee blood level is at or < 60 µgm/100ml of whole blood.
- For an employee of child bearing capacity, when two consecutive blood sampling tests indicate that the employees blood level is at or < 40 µgm/100ml of whole blood.
- An employee removed when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has detected medical condition which places the employee at increases risk of material impairment to health from exposure to lead.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to lead.

All suspended cases should have repeat blood lead examinations (and relevant biochemical tests where indicated) at monthly intervals. They should not return to lead work until the blood lead level has fallen to below the return levels (see above), all other biochemical results have returned to normal and any related signs and symptoms have disappeared.

6.3 TREATMENT

All cases of lead poisoning must be immediately removed from exposure and referred for hospital treatment. Chelation therapy with infusion of versenate and/or oral penicillamine may be instituted.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work process
- ❑ Work-place hygiene
- ❑ Use of approved Personal Protective Equipment
- ❑ Appropriate signage

8.0 REFERENCES

1. Factories and Machinery (Lead) Regulations, 1984.
2. Health & Safety Executive: Control of lead at work -approved code of practice. UK, 1981.
3. Federal Register: Occupational exposure to lead -final standard; USA 1978.
4. WHO: Recommended health-based limit in occupational exposure to heavy metals; Technical Report Series 647, 1980; 74-6.
5. WHO: Diseases caused by lead and its toxic compounds. In: Early detection of occupational diseases. Geneva, 1986: 85-90.
6. Barry PSI: Lead: Occupational and environmental exposure. In: Gardner A W, ed. Current approaches to occupational medicine. Bristol, UK, 1979: 1-17.
7. Zielhuis RL: Lead: Alloys and inorganic compounds. In: Encyclopaedia of Occupational health and safety. International Labour Office, Geneva, 1983: 1200-4.
8. Phoon WH, Lee HS, Ho CK: Biological Monitoring of workers exposed to inorganic lead in Singapore. Singapore Med J 1990; 31: 127-30.
9. American Conference of Governmental Industrial Hygienist: Documentation of threshold limit values and biological exposure indices, Cincinnati, 1999: BEI-99.
10. National Board of Occupational Safety and Health: Ordinance AFS Sweden. 1992: 17.

19.2 ORGANIC LEAD (TEL, TML)

1.0 SYNONYMS: Plumbum

2.0 OCCUPATIONS AT RISK OF EXPOSURE TO ORGANIC LEAD

- Cleaning of tanks containing leaded gasoline or aviation fuel
- Production and transportation of anti-knock agents (organic lead compounds)
- Blending anti-knock fluid and raw gasoline at refineries of anti-knock agents

3.0 TOXIC EFFECTS

Mainly on the central nervous system (usually acute)

Mild: Headache, tremor, nervousness, agitation, insomnia, troubled dreams

Severe: Hallucinations, mental confusion, coma, and death

(Note: In addition to the inhalation route, organic lead may be absorbed through the skin)

4.0 MEDICAL SURVEILANCE PROGRAMME

Any work where workers are exposed to levels of airborne lead which are liable to be in exceed 50% of the permissible exposure level, and/or where there is risk of skin contact with lead alkyls.

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and history, with particular emphasis on the:

- CNS
- Estimation of urinary lead concentration in an early morning urine specimen collected at the end of the workweek.

***Note: -**

i) More frequent tests may be done depending on exposure.

ii) The tests need only be done before and after the job in case of intermittent exposures e g tank cleaning

4.2 WHERE INDICATED THE FOLLOWING MAY BE DONE:

- Blood lead level (lipid-extractable phase of blood sample) - collect in lithium heparinised tube.
- Electroencephalography (EEG)

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected lead poisoning and excessive absorption.
- Cases with urine lead of more than 150 µg/litre in 2 successive examinations.

All cases recommended for MRP and suspected cases of lead

poisoning/excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests.

6.1 ABNORMAL RESULTS

If the urine lead is 150 µg/litre or more, repeat test

Immediately.

6.2 MEDICALLY REMOVED CASES & RETURN TO WORK

All suspended cases should have repeat urine lead examinations at monthly intervals and should not return to lead work until the urine lead level falls below 150 µg/litre and symptoms have disappeared.

6.3 TREATMENT

Treatment with chelating agents does not appear to be useful for organo-lead poisoning. Symptomatic and supportive treatment is indicated. Several weeks to years may be necessary for recovery, which may not be complete.

7.0 PREVENTIVE MEASURES

- As for inorganic lead

8.0 REFERENCES

1. Factories and Machinery (Lead) Regulations, 1984.
2. Health and Safety Executive: Control of lead at work-approved code of practice. UK, 1981.
3. Federal Register: Occupational exposure to lead -final standard: USA 1978.
4. World Health Organisation: Recommended health-based limit in occupational exposure to heavy metals; Technical Report Series 647, 1980.
5. Philippe Grandjean: Biological effects of organolead compounds. CRC Press, 1984.

20. MANGANESE

1.0 SYNONYMS: Manganese Dioxide, Potassium Permanganate, Pyrolusite

PEL 8hr TWA

Manganese, elemental & inorganic cpds as Mn
0.2mg/m3
Manganese cyclopentadienyl tricarbonyl 0.1mg/m3

Physicochemical properties

Reddish or steel grey metal, chemical element, compound in many colours.

Route of entry

Inhalation, dermal, ingestion.

Manganese salts are strong irritants
Manganese salts produce chronic disease
CNS lesions occur in frontal lobes and basal ganglia.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Milling of manganese ore
- Manufacture of dry-cell batteries (manganese dioxide)
- Iron and steel industry as a reagent to reduce sculpture and oxygen
- Manganese electroplating
- Manufacture of paints, varnishes, inks and dyes, fertilisers, feed
- Additives, disinfectants and bleaching agents, glass and ceramics (decoloriser and coloring agent)
- Manufacture of matches and fireworks
- Manufacture of potassium permanganate
- Welding operations with manganese coated rods
- Water treatment

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Manganese dust & fumes cause minor irritation to the eyes & mucous membranes of the respiratory tract. Fume inhalation may result in metal fume fever. Manganese dust is not believed to be a causative factor in pneumonia. If at all, it is only an aggravating factor to a pre- existing condition.
- Manganese salts (higher valency) - caustic effects Symptoms: Papulo-erythematous dermatitis, metal fumes fever, bronchitis and pneumonitis.

Other acute effects Papuloerythematous dermatitis, metal fumes fever, bronchitis and pneumonitis

3.2 CHRONIC EFFECTS

- Manganese (bivalent) compounds cause damage to the central nervous system and lungs**.**

Central nervous system: 3 phases:

- Sub-clinical stage with vague symptoms
- Early clinical stage with acute psychomotor disturbances, speech and gait disturbances, tremors, loss of memory, flat affect
- Fully developed stage with manic depressive psychosis and parkinsonism.

Lungs: Increased incidence of pneumonia, acute and chronic bronchitis**.**

CHRONIC EFFECTS are also classified as follows:

CNS: 1 -2 years exposure

State I:

Asthenia and apathy, nervousness, headache, Anorexia, Pains in lower extremities,Somnolence,Impotence .

State II:

Slow monotonous speech with stammering, mask like faecies. Muscular incoordination, tremors, cogwheel phenomena, emotional disturbances, gross rhythmical **movement of arms, legs, trunk and head.**

State III:

Muscular hypertonia, increase deep tendon reflexes, paralysis of lower extremities.

Spastic in-cordination of gait with propulsion and retropulsion.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the -in-air standard, and or where there is significant risk of absorbing it.

Diagnostic criteria

- Elevated content of manganese in blood and urine, but disease may exist without such elevations
- Gold curve of spinal fluid shows slight rise at mid-zone.
- Albumin may be increased and manganese may be present.

Health Safety Executive (UK) Guidelines for Exposure
Blood 7.1-10.4 mg/L
Urine 19 ng/L

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular attention to:

- Behavioural and
- Neurological changes (speech and emotional disturbances, hypersonic, tremor, equilibrium, gait, handwriting & adiadochokinesis)

- **Urine manganese estimation (early morning specimen corrected for creatinine)**

Preclude from exposure those individuals with disease of liver, kidneys and central nervous system or alcoholism.

4.2 PERIODIC MEDICAL EXAMNIATIONS

Tests are conducted annually as for pre-placement

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE:

- Blood manganese estimation (venous sample in heparinised container)
- Full blood count (including Total White and differential count)
- Liver and kidney function

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

No **BEI** values available however the HSE guidelines may be used.

All cases recommended for suspension and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

If the urine or blood level exceeds, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the urine / blood level falls below normal levels, symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to manganese.

6.3 TREATMENT

- Supportive, Irrigate eyes with water
- Wash contaminated areas of body with soap and water
- Gastric larvage, if ingested, followed by saline catharsis
- Oxygen and artificial respiration
- Supportive measures
- Refer to hospital

7.0 PREVENTIVE MEASURES

Adequate ventilation, Chemical goggles, Chemical cartridge respirator, polyvinyl gloves. appropriate signs.

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations)

Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1995.

2. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio. 1987: 86-8.

3. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.

4. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance-Manganese The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989:1/8.

21. MERCURY

1.0 SYNONYMS: quick silver, mercuric arsenate, chloride, phosphate, thiocyanate

	PEL 8hr TWA: Mercury as Hg
Alkyl compounds	0.01 mg/m3
Aryl compounds	0.1 mg/m3
Inorganic forms, including metallic Hg	0.025 mg/m3

PHYSICOCHEMICAL PROPERTIES:

Silvery liquid Metallic Hg evaporates at room temperature.

Absorption **Mercury enters the body mainly through the lungs as vapour or dust. About 80% of inhaled Hg is absorbed. Some organic and inorganic Hg (II) compounds may be absorbed through the skin. The daily intake of Hg with food is in the range of a few micrograms.**

Biotransformation Absorbed **elemental Hg is quickly oxidised to the Hg 2+ ion, which has an affinity with sulhydryl (-SH) groups, and is concentrated in the kidneys (bound to metallothionein) and liver. Hg is able to pass through the** blood-brain barrier and placenta**.** Hg accumulates in the kidneys, liver, spleen and bones. Metallic Hg is lipid soluble and is transported through membranes without hinderance.

Excretion **Elemental Hg and its inorganic compounds are eliminated in the urine and organic compounds in the feces (up to 90%). The biological half-life of inorganic Hg is about 6 weeks.**

2.0 OCCUPATIONS AT RISK OF EXPOSURE

A. INORGANIC MERCURY

- Electrolytic production of sodium hydroxide, chlorine, & acetic acid (as fluid cathode)
- Manufacture of scientific instruments, electrical equipment, mercury vapour & incandescent lamps, X-ray tubes, radiovalves and artificial silk
- Dentistry & Taxidermy
- Manufacture of amalgams (with copper, tin, silver, gold) and solders (with lead & tin)
- Plating of gold, bronze, silver & tin (jewelers)
- Paint and pigment manufacture
- Tanning & dyeing, felting
- Used as a catalyst in the chemical industry e.g. production of acetic acid & acetaldehyde from acetylene
- Photography & photogravure
- Mining & extraction of gold and silver from ores
- Laboratories-soil testing (Hg used a pressure medium)
- Brewery (malt analysis for protein content)

2.0 TOXIC EFFECTS

A. *INORGANIC AND ELEMENTAL MERCURY*

3.1 ACUTE *EFFECT INORGANIC AND ELEMENTAL MERCURY*

- Chemical pneumonitis -chest pain, dyspnea, cough

- Gastrointestinal tract irritation
- Circulatory collapse
- Acute renal failure

3.2 CHRONIC EFFECT *INORGANIC AND ELEMENTAL MERCURY*

- Weight loss, Insomnia
- Erythrism
- Tremor
- Dysarthria
- Mercurialentis
- Gingivitis, Stomatitis
- Excessive salivation
- Metallic taste

B. *ORGANIC MERCURY*

(Alkyl compounds e.g. methyl mercury and aryl

Compounds e.g. phenyl mercury acetate)

2.0 OCCUPATIONS AT RISK OF EXPOURE

B. *ORGANIC MERCURY*

- Manufacture & use of certain pharmaceuticals of products (e.g. antiseptics, germicides, diuretic and contraceptives)
- Manufacture & use of pesticides (algaecides, fungicides, herbicides)
- Manufacture & use of paints & waxes
- (E.g. antifouling paints, preservatives in paints, latex paints, fungus proofing of fabrics, paper, wood)
- Used as catalyst and alkylating agents in the chemical industry

3.1 ACUTE E EFFECTS *B. ORGANIC MERCURY*

Irritation of the mucous membranes

Chemical pneumonitis

Poisoning (may be acute or chronic)

- Neurological symptoms e.g. paresthaesia, concentric constrictions of the visual fields,
- Impairment of hearing, rigidity, tremor, ataxia, chronic seizures
- Fatigue, dyspnoea, chest & abdominal pain, vomiting
- Symptoms of inorganic poisoning may be present including renal damage
- Dermatitis
- Prenatal intoxication may occur resulting in fetal brain damage

Note: Elemental Mercury volatizes at room temperature. Mercury and some of its compounds can. be absorbed through intact skin

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne mercury which are liable to be in excess of 10% of the permissible exposure level and/ or where there is significant risk of ingesting it. Skin absorption may be relevant.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling Time	BEI
Total inorganic mercury in	Preshift	35µg/g creatinine

urine		creatinine
Total inorganic mercury in blood	End of shift at end of workweek	15 µg/L

Source: TLVs & BEIs ACGIH 2000

Exposure to Hg may be monitored from concentrations of Hg in blood and urine.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination & baseline data with particular attention to:

- ♦ Symptoms of weight loss, insomnia & personality changes and the
- ♦ Central nervous system, including tremors.
- ♦ Skin for dermatitis or burns in case of organic mercury.
- ♦ Urinary mercury (total Hg) estimation early morning specimen corrected for creatinine. Ensure worker avoids seafood for 3 days prior to urine collection.

4.2 PERIODIC MEDICAL EXAMINATION

Annually, as for Pre-employment, annually, but if exposure is high more frequently.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- ♦ Urine for albumin and microscopic examination
- ♦ Renal function tests, serum albumin/ globulin
- ♦ Blood total Hg for workers exposed to alkyl Hg

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ♦ All cases of definite or suspected poisoning & disease and excessive absorption. (i.e. urine Hg 35 µg/g creatinine)

All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If abnormal urine Hg level exceeds 35 µg/g creatinine a repeat test must be done immediately, symptoms & signs persist; a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine Hg at monthly intervals should not return to work until the Urine Hg levels falls below 35 µg/g creatinine and signs and symptoms have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to mercury.

6.3 TREATMENT

All cases of poisoning must be immediately removed from exposure and referred for hospital treatment. Wash contaminated areas of body with soap and water.

Chelation in the early stages e.g. Calcium EDTA; oral L-dopa reduces hypertonia, contractions and speech disturbances.

7.0 PREVENTIVE MEASURES

- ❑ Women in the reproductive age should not work in areas where there is significant Hg exposure (particularly alkyl Hg)
- ❑ Improvement in work process, Adequate ventilation, Use of Personal Protective equipment, Chemical goggles, medical surveillance
- ❑ Appropriate signage

8.0 REFERENCES

1. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1997.
2. World Health Organisation; Early detection of occupational diseases Geneva , 1986: 79-84.
3. American Conference of Governmental Industrial Hygienist : Documentation of the Threshold Limit Values and Biological Exposures Indices , Cincinnati 1999.
4. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4 th. edition, 1988.
5. World Health Organisation. Recommended Health-based Limits in Occupational Exposure to Heavy Metals - Report of a WHO Study Group, Technical Report Series 647, 1980.
6. Linch A L : Biological Monitoring for Industrial Chemical Exposure Control, CRC Press, Florida, 1980.
7. National Institute for Occupational Safety and Health : Criteria for a Recommended Standard. . . . Occupational Exposure to Inorganic Mercury . us Department of Health, Education and Welfare, USA 1973 (HSM-73-11024).
8. Friberg L & Vostal J: Mercury in the Environment, CRC Press, Cleveland, 1976.
9. World Health Organisation : Recommended Health-based Limits in occupational exposure to heavy metals - Report of a WHO Study Group, Technical Report Series 647,1980: 102-115.
10. National Institute of Occupational Safety and Health/Occupational Safety and Health Administration: Occupational Health Guidelines for Chemical Hazards 1981: Vo12.

22. MINERAL OIL INCLUDING PARAFFIN

1.0 SYNONYMS: Coolant

PHYSICOCHEMICAL PROPERTIES

Petroleum derivatives

Route of absorption

Inhalation, dermal

Mode of action

Irritant.

Carcinogenicity due to carcinogenic **aromatic hydrocarbon** and contamination with **nitrosoamines**

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Cutting/ lubricating oils/ fluids.

3.0 TOXIC EFFECTS

- Skin irritation
- Oil acne-usually occurs in areas contaminated by oil.
- Epitheliomata of scrotum (scrotal cancer) have been reported after many years of exposure.
- Possibility of respiratory, bladder and gastrointestinal cancer has been suggested

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the -in-air standard and or where there is significant risk of ingesting it.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular attention to:

- Skin diseases
- Chest X-ray may show increased linear striations
- Kidneys
- Neurological and
- Respiratory system

4.2 PERIODIC MEDICAL EXAMINATIONS

This has to be done yearly as for pre-placement.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If the symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of

material impairment to health from exposure to mineral oil including paraffin.

6.3 TREATMENT

- Symptomatic and supportive
- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- Irrigate eyes with water
- Wash contaminated areas of body with soap and water

7.0 PREVENTIVE MEASURES

Adequate ventilation. Mechanical filter respirator. Encourage personal hygiene. Protective clothing. Educate employees to report all early skin lesions. Barrier creams. Appropriate signage.

8.0 REFERENCES

Waterhouse, J. A. H. Lung Cancer And Gastrointestinal Cancer In Mineral *Oil* Workers," *Ann. Occup. Hyg.* 15:43, 1972.

23. b-NAPHTHYLAMINE

1. 0 SYNONYMS: 2 Aminonapthalene, 2 naphthylamine

PHYSICOCHEMICAL PROPERTIES

Colourless crystals which darken in air to a reddish purple colour. It is an aromatic amine.

PEL 8 hr TWA : 0

Route of entry

Dermal-well absorbed through skin
Inhalation
Ingestion.

Mode of action: Carcinogen, local & systemic toxicity.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical synthesis
- Dyes

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

Acute over exposure can cause methmoglobinemia
Acute Haemorrhagic cystitis

3.2 CHRONIC EFFECTS

- Dysuria
- Haemorrhagic cystitis, hematuria, **Bladder cancer**
- **Known Human Bladder carcinogen (IARC A1)**
- Dermatitis
- Ataxia
- Methemoglobinemia

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the-in-air standard and or where there is significant risk of absorption, ingesting inhalation.

4.1 4.1 PRE-EMPLOYMENT MEDICAL EXAMINATION

Clinical examination & baseline data with particular attention to:

- Skin
- Liver, haematopoietic (blood forming) &
- Respiratory systems
- Urinary tract
- Urine cytology

Urine estimation (early morning specimen corrected for creatinine)

4.2 PERIODIC MEDICAL EXAMIANTION

As for pre-placement but done annually.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Blood, Full blood count.
- Urine Cytology if high exposure every 6 months.

5.0 INDICATIONS FOR MEDICAL REMOVAL

- All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION Repeat tests

6.1 ABNORMAL RESULTS:

If the investigations, symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to b-naphthylamine.

6.3 TREATMENT

All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.

Wash contaminated areas of body with soap and water

7.0 PREVENTIVE MEASURES

- ❑ Education of worker not to smoke as this chemical is found in cigarette smoke,
- ❑ Engineering control, Adequate ventilation,
- ❑ Approved PPE, Any self-contained breathing apparatus with a full face-piece and operated in a pressure demand or positive pressure mode. Chemical goggles, mechanical filter respirator.
- ❑ Signage – CARCINOGEN.

8.0 REFERENCE

1. Brsant-Rauf PW Goldstein MD Bladder Carcinogens and Surveillance in Environmental and Occupational Medicine 2nd Edition Little Brown & Co, Boston, 1992: 881.

2. Poisoning & Drug overdose Olson KR a Lang clinical manual 1999,497t Poisoning & Drug overdose Olson KR a Lang clinical manual 1999, 104-5

24. 1- NAPHTHYLAMINE & ITS SALTS

1.0 SYNONYMS: 1 –Naphtalamine

Physicochemical properties

1-Naphthylamine (often contains 2-naphthylamine as an impurity)

White to reddish lustrous crystals.

It is an aromatic amine.

Route of absorption

Inhalation. Skin

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical synthesis
- Dyes
- Rubber

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Methemoglobinemia
- Hematuria
- Dysuria

3.2 CHRONIC EFFECTS

- Haemorrhagic cystitis
- Dermatitis
- **Bladder cancer, skin cancer**

A2 Suspected Human Carcinogen

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels, which are liable to be in excess of half the -in-air standard, and or where there is significant risk of ingesting it.

Screening of workers can done as for benzidine.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS:

Clinical examination & baseline data with particular attention to :

- Kidneys
- Neurological &
- Respiratory system
- **Urine estimation (early morning specimen corrected for creatinine)**

4.2 PERIODIC MEDICAL EXAMINATIONS:

Annually as for pre-employment.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

Full blood count.

Urine examination every 6 months.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.
- All cases recommended for and suspected cases of poisoning / excessive absorption must be notified to DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

If the urine symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of

material impairment to health from exposure to 1-naphthylamine.

6.3 TREATMENT

- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- Irrigate eyes with water
- Wash contaminated areas of body with soap and water
- Gastric larvage, if ingested, followed by catharsis

7.0 PREVENTIVE MEASURES

- Adequate ventilation, Chemical goggles, Rubber gloves, appropriate signage.

8.0 REFERENCES

Plunkett E R Handbook of industrial Toxicology Heyden 1986.

25. ORTHOTOLIDINE AND ITS SALTS

1. SYNONYMS: bianisidine, 3,3' dimethylbenzidine

Physicochemical properties

White to reddish solid. Decomposes on burning, producing hazardous oxides of nitrogen.

PEL 8 hr TWA: 0

Route of entry

Inhalation

Mode of action

Bladder cancer

Skin irritant

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical synthesis

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Irritant to eyes, skin, respiratory tract, liver, kidney, bladder
- Cough

3.2 CHRONIC EFFECTS

- Skin irritation
- Mammary gland tumours (IARC 2B)

A carcinogen in test animals

4.0 MEDICAL SURVEILLANCE PROGRAMME

Indications:

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the-in-air standard and or where there is significant risk of ingesting it.

4.1 PRE-EMPLOYMENT MEDICAL EXAMINATION

- Clinical examination with particular attention to kidneys
- neurological and
- respiratory system.

Urine estimation (early morning specimen corrected to SG of 1.016)

4.2 PERIODIC MEDICAL EXAMINATION

- To be conducted annually.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

Blood, Full blood count, Urine examination every 6 months.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

- If the urine symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to orthotolidine and its salts.

6.3 TREATMENT

- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- Irrigate eyes with water
- Wash contaminated areas of body with soap and water
- Gastric larvage, if ingested, followed by catharsis

7.0 PREVENTIVE MEASURES

- ❑ Adequate ventilation,
- ❑ Chemical goggles, mechanical filter respirator,
- ❑ Rubber gloves
- ❑ Appropriate signage

8.0 REFERENCES

1. Olson KR. Poisoning & Drug overdose, A Lang Clinical manual: Prentice-Hall Int. (UK) Ltd., London; 1999: 522t.

2. NIOSH USA

26. DIANISIDINE AND ITS SALTS

1.0 SYNONYMS: o, o Dianisidine

Physicochemical properties

White to violet crystals

Insoluble in alcohol and benzene

It is an aromatic amine

PEL 8 hr TWA: 0

Route of Entry

Inhalation

Dermal

CONFIRMED CARCINOGEN

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- ➢ Chemical synthesis

- Dye intermediate
- Printing

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Irritant to eyes, skin, upper respiratory tract
- Induces methaemoglobinaemia
- Toxic hepatitis

3.2 CHRONIC EFFECTS

- **Carcinogen: cancer of the bladder**

MEDICAL SURVEILLANCE PROGRAMME

- ♦ General examination with emphasis to the renal and haematological system.
- ♦ Urine cytology

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data with particular attention to:

- ♦ Urine cytology
- ♦ Renal function test

4.2 PERIODIC MEDICAL EXAMINATION

- ♦ As for pre-placement, conducted annually.

5.0 INDICATIONS MEDICAL REMOVAL PROTECTION

- ♦ All cases of definite or suspected poisoning /disease and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If results are abnormal, repeat it and if still abnormal remove the worker and refer to the urologist.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat investigation urine examinations and relevant biochemical tests where indicated and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to dianisidine and its salts.

6.2 TREATMENT

- ▪ All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- ▪ Wash contaminated areas of body with soap and water.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work-process & workplace hygiene
- ❑ Adequate ventilation,
- ❑ Approved Personal Protective equipment, Chemical goggles
- ❑ Appropriate signage

8.0 REFERENCES

1. International Labour Office:
Encyclopaedia of Occupational Health and
Safety, Geneva, 4th edition, 1998

27. DICHLOROBENZIDINE & ITS SALTS

1.0 SYNONYMS : DCB, 3,3'-dichlorobi-Phenyl-4,4'diamine

Physicochemical properties

Grey to purple crystalline solid with a faint odour.

PEL 8 hr TWA : 0

Absorption

Inhalation

Well absorbed through the skin

Gastrointestinal tract

2.0 OCCUPATIONS AT RISK OF EXPOURE

- Chemical synthesis

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- General headache dizziness, nausea, vomiting
- Skin allergic reaction, dermatitis,
- Caustic to skin
- Eye severe irritation

3.2 CHRONIC EFFECTS

- Causes blood in urine, and painful, difficult, or frequent urination
- Sensitizer
- Liver and breath cancer
- Reduced fertility

IARC 2B Probable Human carcinogen

ACGIH A3 Animal carcinogen

Causes **Bladder cancer**

3.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to dichlorobenzidine & its salts.

Please refer to Benzidine for Recommended guidelines for bladder screening.

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data with particular attention to:

General health profile -

- ♦ Liver, Skin, Respiratory tract, Kidney & full blood picture.

Specific -

- ♦ Urine cytology
- ♦ Urine benzedine

Biological monitoring is by testing Benzidine in urine.

It is suggested that the medical surveillance for **respiratory disease** should be conducted by using the principles and methods recommended in the modified Medical Research Council , London **Questionnaire on respiratory symptoms.**

Please use the format developed by Prof Madya Noor Hashim Ismail et al Hospital, UKM. Cheras.

4.2 PERIODIC MEDICAL EXAMINATION

Conducted annually but much more frequently if exposure is high.

- ♦ Urine cytology
- ♦ Urine benzedine
- ♦ Full blood count

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ❖ All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If the urine levels are exceeded, a repeat test must be done immediately. Refer to **urologist.**

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat tests
- ❖ Return to work is when there are no symptoms and sign of disease.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to**.** dichlorobenzidine & its salts.

6.3 TREATMENT

First Aid: Shower as soon as possible unless contraindicated by physical injuries.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work process
- ❑ Work-place hygiene
- ❑ Use of approved PPE. A complete respiratory protection programme. Mechanical filter respirator. Pressurized suit in particular hazardous places, Chemical goggles, Rubber gloves.
- ❑ Compulsory changing of working clothes.
- ❑ Appropriate signage

8.0 REFERENCES

4. Occupational Safety and Health Guideline for 3,3' dichlorobenzidine, Potential Human Carcinogen OSHA USA.

5. Mycroft FJ, Hiatt PH . The toxic hazards of industrial and Occupational chemicals In : Olson KR, Poisoning & Drug Overdose by California Poison Control System, A Lange clinical manual, Prentice Hall Int.(UK) Ltd,London,1999:461t.

28. NITRODIPHENYL

1.0 SYNONYMS: 4-nitrobiphenyl, p- nitro biphenyl

Physicochemical properties: White solid with a sweet odour.

PEL 8hr TWA: 0

Route of Absorption

Inhalation

Dermal- extremely well absorbed

Eye contact

Ingestion

Metabolised to 4-Aminodiphenyl which is a potent carcinogen in humans.

Thermal breakdown products include oxides of nitrogen.

2.0 OCCUPATIONS AT RISK OF EXPOURE

- Chemical intermediates in the synthesis of pharmaceutical products.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Headache
- Lethargy
- Painful urination
- Blood or pus in the urine

3.2 CHRONIC EFFECTS

- Headache weakness dizziness a feeling of euphoria breathing difficulty (dyspnoea)
- Impaired muscular coordination (ataxia)
- Blood or pus in the urine and painful or frequent urination

4.0 MEDICAL SURVEILLANCE PROGRAMME

Please refer to **Recommended guidelines for bladder cancer screening as for Benzidine**

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination and baseline data with particular attention to:

- Kidneys - urine cytology
- Neurological and
- Respiratory system

4.3 PERIODIC MEDICAL EXAMINATION

As for Pre-employment. To be done annually but if exposure is high carry it out. Bladder cystoscopy if indicated.

5.0 INDICATIONS MEDICAL REMOVAL PROTECTION

All cases of definite or suspected poisoning /disease and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If abnormal, symptoms & signs persist, a repeat test must be done immediately.

Refer to urologist.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat investigation urine examinations and relevant biochemical tests where indicated and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to Nitrophenyl.

6.3 TREATMENT

- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.

- Wash contaminated areas of body with soap and water.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work-process & work-place hygiene
- ❑ Adequate ventilation
- ❑ Personal Protective Equipment
- ❑ Chemical goggles
- ❑ Appropriate signage

8.0 REFERENCES

9. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
10. Olson KR Poisoning and Drug Overdose A Lang clinical manual 1999: 499t.
11. Occupational Safety and Health Guideline for 4-Nitrobiphenyl U.S. NIOSH, 1998.

29.0 NITRO OR AMINO DERIVATIVES PF PHENOL AND OF BENZENE OR ITS HOMOLOGUES

29.1 NITROBENZENE

1.0 PHYSICOCHEMICAL PROPERTIES:

Colourless oily liquid turns yellow on exposure to air. Odour of bitter almonds

PEL 8hr TWA: 1 ppm

Route of entry

Inhalation-80% is absorbed through lungs. Skin absorption of the vapour is possible, Liquid nitrobenzene is readily absorbed by the skin.

Biotranformation

It is metabolised by both oxidation and reduction: the former leads to p-nitrophenol

and the latter to aniline, which is further oxidised to p-amniophenol

Excretion

16% of absorbed dose is excreted in urine as p-nitrophenol and less than 10% as p-amniophenol.

Both are eliminated as sulphate and glucuronide conjugates.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical workers in chemical intermediate and solvent
- Dye makers
- Explosive manufacture

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

Blood –effects as aniline

Skin-dermatitis (due to primary irritation or sensitisation)

Symptoms; Irritating to eyes. Signs and signs of overexposure result from loss of oxygen carrying of the blood. Onset of symptoms of methaemoglobinemia may be insidious and may be delayed up to 4 hours.

Headache is commonly the first sign and becomes severe as methaemoglobinemia increases.

Signs: ataxia, cyanosis develops when methaemoglobin level is 15-g/100 g Hb or more. Effects of methaemoglobinaemia are regarded as acute and promptly reversible. Severe exposures may produce more lasting effects on the blood, liver, and nervous system.

Level of when methaemoglobin level is g/100 g Hb	Symptoms/ signs
15	Cyanosis, blue lips, nose, earlobes. Individual feels well and has no complaints
40- 70	Headache, weakness, dizzy, ataxia, dyspnea on mid exertion, tachy-cardia, nausea, vomiting, drowsiness
> 70	Coma
85-90	Lethal

Source: World Health Organisation Early detection of occupational diseases, 1986

EXPOSURE – EFFECTS RELATIONSHIP

Nitrobenzene mg/m3 air	Symptoms/ signs
15-30	Headache, vertigo, Effects of increased methaemoglobin & sulfahaemoglobin
200 for 6 months	Intoxication, anaemia

3.2 CHRONIC EFFECTS

Blood-anaemia

Liver- jaundice,

Systemic Weight loss, poor appetite

Bladder tumours

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the -in-air standard and or where there is significant risk of ingesting it.

BIOLOGICAL ASSESSMENT

Measurement of urinary p-nitrophenol at end of work-shift.

Level of nitrobenzene in air Mg/m3	p-nitrophenol mg/Litre of urine
5	1.5-5.5

Source: World Health Organisation Early detection of occupational diseases. 1986

Measurement of blood methaemoglobin (normal level of 1.5 g per 100g Hb) may also prove to be useful method of assessing exposure.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
Total p-nitrophenol in urine	End of shift at end of work week	5 m g/g creatinine
Methemoglobin in blood	End of shift	1.5 % Haemo-globin

Source: TLVs & BEIs ACGIH 2000

4.1 PRE-PLACEMENT MEDICAL EXAMINATION

Clinical examination & baseline data with particular attention to detecting pre-existing abnormalities of: -

- Cardiovascular system,
- Lungs and
- Blood

Susceptible are hereditary haemoglobinopathies, congenital heart disease, causing cyanosis and, chronic alcoholism,

- **Urine estimation (early morning specimen corrected to SG of 1.016)**

4.2 PERIODIC MEDICAL EXAMINATION

An annual check similar in content to the pre-placement examination is appropriate. Blood test to detect:

- Anaemia (Hb, haematocrit)
- Abnormalities of liver function

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Blood Heinz bodies in severe poisoning
- Full blood count
- Urine every 6 months

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION.

- All cases of definite or suspected poisoning and excessive absorption. All cases recommended for suspension and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

If the symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to nitrobenzene.

6.3 TREATMENT

- ▪ Almost same as for aniline poisoning.
- ▪ All cases of poisoning must be immediately removed from exposure.
- ▪ Hospital treatment.
- ▪ Irrigate eyes with water
- ▪ Wash contaminated areas of body with soap and water

7.0 PREVENTIVE MEASURES

- ❑ Adequate ventilation
- ❑ Chemical goggles, mechanical filter respirator, rubber gloves
- ❑ Appropriate signage

8.0 REFERENCES

1. World Health Organisation; Early detection of occupational diseases Geneva, 1986: 138-141.

2. American Conference of Governmental Industrial Hygienist: Documentation of the Threshold Limit Values and Biological Exposures Indices, Cincinnati 1999.

3. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance-nitrobenzene: pneumo-coniosis in The Health and Safety Fact book Health & safety Executive, Professional Publishing Ltd London, 1989:1/5.

29.2 ANILINE

1.0 PHYSICOCHEMICAL PROPERTIES

Colourless to pale yellow oily liquid with an aromatic odour.

PEL 8hr TWA : 2 ppm

Route of absorption

Inhalation-mainly

Dermal – especially of liquid, (vapour) through contaminated clothes, gloves & shoes.

Biotransformation: 15-60 % of absorbed aniline is oxidised to p-aminophenol. Which is excreted in urine as glucuronide and sulphate conjugates. The intermediate metabolite, phenyl hydroxylamine is responsible for toxic effects of aniline mainly methaemoglobinemia.

Excretion It is not found in expired air. In exposed workers the urinary p-aminophenol

Appears to be directly related to the blood methaemoglobin concentration. p-aminophenol accounts for 20-40 % of the absorbed dose.

Non -occupational exposure.

Aniline is present in household dyes. It is a metabolite of phenylhydroxylamine. Nitrobenzene, acetanilide, phenacetin, phenazopyridine and some pesticides.

Elevated level of methaemoglobin of > 1.5 g per 100 g haemoglobin.

level	
15 mg/100g Hb	Cyanosis, feel unwell
40 mg/100g Hb	Weak, dizzy,
40- 70 mg/100 Hb	Ataxia, dyspnoea, on mild exertion, tachycardia, Headache
>70 mg/100 Hb	Coma
85-90 mg/100 Hb	Lethal

Source: World Health Organisation Early detection of occupational diseases, 1986

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Chemical Manufacture of dyes, rubber, accelerators and antioxidants, pharmaceuticals, resins, varnishes, perfumes and
- Rubber works used as a solvent in vulcanizing agent in rubber manufacture

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Liquid aniline is irritating to the eyes
- Following skin absorption symptoms may be delayed for 4 hrs, it induces formation of methaemoglobin (reducing oxygen transport). Symptoms become intense as the level of methaemoglobin increases.

Methaemoglobin	**Symptoms / signs**

Exposure lasting several hrs at 25-200 mg causes mild symptoms and at above 400-600 mg/m3 for 1 hour serious **Methaemoglobin** results.

3.2 CHRONIC EFFECTS

- Liver & cerebral effects

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the -in-air standard and or where there is significant risk of ingesting it.

Biological assessment - urinary p-amino-phenol

Exposure hours of aniline for 8 hrs at air concentration of mg/m3	**Rates of** urinary p-aminophenol	Urinary p-amino-phenol **mg within first 24 hrs.**

mg/m3		
5	At 4 the hour 1.5 mg/hr	35
19	At 6 th hour 13 mg/hr	150

Source: World Health Organisation Early detection of occupational diseases, 1986

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
Total p-aminophenol in urine	End of shift	50mg/g creatinine
Methemoglobin in blood	During or End of shift	1.5% of hemoglobin

Source : TLVs & BEIs ACGIH 2000

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination & baseline data with particular attention to:

- Cardiovascular system
- Respiratory
- Blood

Special attention should be paid to individual's hyper sensitive to **Methaemoglobinemia.**

- **Urine estimation (early morning specimen corrected for creatinine)**

4.2 PERIODIC MEDICAL EXAMINATIONS

Annual review similar to the pre-placement examination is appropriate.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Blood-Erythroblastic inclusions (Heinz bodies develop in serious poisoning but haemolysis is rare
- Full blood count
- Urine examination every 6 months

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

- If the urine symptoms & signs persist, a repeat test must be done immediately.
- Refer urologist for abnormal cytology.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to aniline

6.3 TREATMENT

- All aniline on the body must be removed immediately remove and discard all clothing, gloves and footwear.
- Wash the whole body with soap and water.
- Pay special attention to hair, finger and toe nails, nostrils, ear canal.
- Determine **Methaemoglobin level** every 3-6 hours for 18-24 hrs**.** Ascorbic acid (IV) and methylene blue have been used in severe cases
- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- Irrigate eyes with water
- Wash contaminated areas of body with soap and water
- Gastric lavrage, if ingested, followed by catharsis

7.0 PREVENTIVE MEASURES

- ❑ Adequate ventilation to control vapour
- ❑ **All workers should know how to recognise early signs of cyanosis**
- ❑ Skin contact must be avoided by use of impervious boot & gloves Chemical goggles, mechanical filter respirator, Rubber gloves
- ❑ Appropriate signage

8.0 REFERENCES

1. World Health Organisation Early detection of occupational diseases Geneva, 1986: 134-138.
2. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation11-Health Surveillance-Aniline: in The Health and Safety Fact book Health & safety Executive, Professional Publishing Ltd London, 1989:1/5.

29.3 TOLUENE

1.0 SYNONYMS: Methylbenzene, Phenylmethane, toluol

Physicochemical properties: volatile, colourless with characteristic odour. Vapour is explosive. It is flammable.

PEL 8hr TWA: 50 ppm

Absorption

Inhalation of its vapours- mainly.

About 40-60% of inhaled amount is retained in body

Skin

Biotransformation About 60-80 % is metabolised into benzoic acid, which then conjugates with glycine to form hippuric acid.

Excretion About 29% of toluene is exhaled. Hippuric acid is rapidly eliminated in urine (almost entirely in 24 hours) .

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Petrochemical workers in toluene production
- Chemical industry & laboratories using toluene as solvent for rubber, tar, asphalt, and cellulose paints and varnishes.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Narcotic- headache, dizzy, drowsy, unconscious death due to respiratory arrest
- Neurotoxic - impairment of co-ordination and memory, nausea, anorexia.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half in the -in-air standard and or where there is significant risk of ingesting it.

Biological assessment

Measurement of urinary hippuric acid at end of work-shift is most important method. The concentration of hippuric acid from food with benzoic acid or benzoates rarely exceeds 0.95 mol per mol of creatinine (1.5g/g).

Exposure level to toluene mg/m3 for 8 hours	Urinary hip uric acid per mol creatinine
200	0.95mol (1.5 g/g)
375	1.58 mol or 2.5.g/g

Source: World Health Organisation Early detection of occupational diseases, 1986

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
O - Cresol in urine	End of shift	**0.5** mg/L
Urinary hippuric acid in urine	End of shift	1.6 g/g creatinine
Toluene in venous blood	Prior to last shift of workweek	0.05 mg/L

Source: TLVs & BEIs ACGIH 2000

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline with particular emphasis on:

- Nervous system
- Liver
- Kidney

Worker with increased susceptibility to toluene:

- ♦ Chronic diseases of central nervous system,
- ♦ Hepatic or
- ♦ Renal function impairments susceptibility.

4.2 PERIODIC MEDICAL EXAMINATIONS

Same as pre-placement carried out every year or 2-3 years depending on the level of exposure, symptoms and signs of disease and biological monitoring results.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE:

- ♦ Full blood count
- ♦ Urine every 6 months

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ♦ All cases of definite or suspected poisoning and excessive absorption.

All cases recommended for MRP and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

If the urine symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to toluene.

6.3 TREATMENT

- ▪ All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- ▪ rrigate eyes with water
- ▪ Wash contaminated areas of body with soap and water

7.0 PREVENTIVE MEASURES

- ❑ Adequate ventilation
- ❑ Chemical goggles
- ❑ Chemical filter respirator
- ❑ Rubber gloves
- ❑ Appropriate Signage

8.0 REFERENCES

1. World Health Organisation; Early detection of occupational diseases Geneva, 1986: 127-30.

3. American Conference of Governmental Industrial Hygienist: Documentation of the Threshold Limit Values and Biological Exposures Indices, Cincinnati 1999.

29. 4 XYLENE

1.0 SYNONYMS: Dimethylbenzene, Xylol

Physicochemical properties

Colourless, volatile liquid with typical aromatic odour. It is flammable

PEL 8 hr TWA : 100 ppm

Route of absorption

Mainly through inhalation of its vapours. About 40-60% of total inhaled amount is retained in the body.

Skin absorption through direct contact with liquid

Biotransformation

About 95 % of absorbed xylene is metabolised to almost entirely to methyl benzoic acid, which then conjugates with glycine to form methylhippuric acid.

Excretion

Elimination of unchanged xylene in exhaled air and of its metabolites (methylhippuric acid) in urine is rapid and reaches completion within 18 hours after termination of exposure.

Biological assessment

Measurement of urinary methylhippuric acid is the most important method. A 8 hour exposure to 200 mg of xylene/m3 of air corresponds to a. urinary methylhippuric acid of about 0.00725 mol/lire (1.4 g/litre) on the basis of samples collected from groups of workers at end of a work shift, corrected for creatinine)

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Petrochemical workers in xylene production
- Workers in chemical industry 9 substrate for organic synthesis) & laboratories using xylene as raw material or solvent for rubber, tar, asphalt, cellulose paints and varnishes.
- Paint (thinner for paints & lacquers) and printing (Rotogravure) workers

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Narcotic effects- dizzy, drowsy, unconsciousness. Death due to respiratory arrest is possible.

3.2 CHRONIC EFFECTS

- Headache, irritability, fatigue, dyspeptic, disorders, sleepiness during the day and sleep disorders at night.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the -in-air standard and or where there is significant risk of ingesting it.

Exposure –effect relationship

Impairment of reaction time was observed in volunteers exposed to 870 mg/m3 for 3 hours

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling time	BEI
Urinary methyl hippuric acid in urine	End of shift	1.5 g/g creatinine

Source : TLVs & BEIs ACGIH 2000

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination & baseline data with particular attention to:

- kidneys
- Neurological and
- Respiratory system

SUSCEPTIBILITY

- Pregnant women
- Those suffering from chronic diseases of:
  - Central nervous system or
  - Diseases impairing hepatic
- Renal functions

4.2 PERIODIC MEDICAL EXAMINATIONS

Same as pre-placement, carried out every year or 2-3 years depending on the level of exposure, symptoms and signs of disease and biological monitoring.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- Specialised Neurological;
- Psychiatric and
- Psychological examinations may be necessary

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.

All cases with evidence of all cases recommended for suspension and suspected cases of poisoning excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests

6.1 ABNORMAL RESULTS

If the symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat urine examinations (and relevant biochemical tests where indicated) at 3-monthly intervals and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to xylene.

6.3 TREATMENT

- All cases of poisoning must be immediately removed from exposure and
- Referred for hospital treatment.

- Wash contaminated areas of body with soap and water
- Gastric larvage, if ingested, followed by catharsis

7.0 PREVENTIVE MEASURES

- Adequate ventilation,
- Chemical goggles/filter respirator,
- Rubber gloves
- Appropriate Signage

8.0 REFERENCES

1. World Health Organisation: Early detection of occupational diseases. Chapter 19, Diseases caused by benzene its toxic homologues, 1986: 122-33.

2. American Conference of Governmental Industrial Hygienist: Documentation of the Threshold Limit Values and Biological Exposures Indices, Cincinnati 1999.

30. 1 NITROUS FUMES

1.0 SYNONYMS: Nitrogen oxides (NOx) (synonym: nitric oxides)

Nitrogen mono-oxide (NO) (synonym: nitric acid)

Colourless, oxidises readily to NO2.The sharp sweet odour occurs below the TLV and is a good warning property.

Nitrogen dioxide (NO2) reddish brown
Dinitrogen monoxide (N2O)

(Synonym: nitrous oxide, laughing gas)

Nitrogen tetraoxide (N2O4): ploymer of NO2

Physicochemical properties

White solid with a sweet odour

PEL 8 hr TWA

Nitrous oxide 50 ppm

Nitrogen dioxide 3 ppm

Nitrogen oxides (nitric oxide or nitrogen dioxide: not nitrous oxide are dangerous chemicals commonly released from:

- Nitrous or nitric acid
- Reactions between nitric acid and organic materials
- Burning of nitrocellulose and many other products

Route of Absorption

Inhalation

NITROGEN DIOXIDE is a irritant, hydrolyses to form nitric acid, nitrous acid and nitric oxide in alveoli of lung this results in:

- Delayed on set of chemical pneumonitis. (Pulmonary oedema)
- Nitrogen oxides can oxidise hemoglobin to methemoglobinem

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Nitrogen dioxide-found industrially in arc and inert gas shielded welding in small-unventilated rooms. (Electric arc welding)
- By product in the manufacture of dyes and explosives

- Electroplating & engraving
- May be evolved from silage
- Is found in engine exhaust
- Produced when stored grain with a high nitrite content ferments

Dinitrogen monoxide is used an anaesthetic gas.

3.0 TOXIC EFFECTS

These depend upon the type and amount of gas. In this case it is for NITROGEN DIOXIDE

3.1 ACUTE EFFECTS

Local	Conjunctivitis, corneal ulceration
Respiratoy	Chest pain, pulmonary odema
Central nervous system	Headache, dizzy, ataxia, delirium, convulsions
Gastro-Intestinal	Nausea, vomiting, Abdominal pain
Circulatory	Decreased pulse rate, Cardiac arrthymia, collapse

3.2 CHRONIC EFFECTS (Inhalation)

May be delayed for 30 hours

Headache, insomnia chronic bronchitis, emphysema.

Nitrous oxide has effects on reproduction, blood, and nervous system. It causes asphyxiation.

Nitric oxides may cause methemoglobinemia

Nitric oxide and nitric tetroxide are irritant to the mucous membranes of the eyes an upper respiratory tract.

In severe cases, pulmonary oedema occurs usually after a latent period (6-24 hrs, up to 72 hrs).

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the -in-air standard and or where there is significant risk of ingesting it.

4.1 PRE- PLACEMENT MEDICAL EXAMIANTIONS

Clinical examination and baseline data with particular attention to:

- Respiratory and
- Cardiovascular system.

4.2 PERIODIC MEDICAL EXAMIANTIONS

As for Pre-employment. To be done annually but if exposure is high carry it out more frequently.

4.3 WHERE INDICATED OTHER TESTS MAY BE DONE

- Methemoglobin determination may be helpful.
- CO2 in blood may be increased
- Chest X-rays-show chemical pneumonits or pulmonary oedema

5.0 INDICATIONS MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning /disease and excessive absorption.

All cases recommended for suspension and suspected cases of poisoning / excessive absorption must be notified to the Director General, Department of Occupational Safety and Health.

6.0 FOLLOW-UP ACTION

6.1 ABNORMAL RESULTS

If abnormal, symptoms & signs persist, a repeat test must be done immediately.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat investigation, examinations and relevant biochemical tests where indicated and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Because of delayed effects all workers with significant inhalation should be observed for several hours.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to nitrous fumes.

6.3 TREATMENT

- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- Wash contaminated areas of body with soap and water.

7.0 PREVENTIVE MEASURES

- Improvement in work-process & workplace hygiene
- Adequate ventilation, Personal Protective equipment,
- Chemical goggles, Gas mask or airline respirator
- Rubber gloves and protective clothing
- No silo should be entered for 7 days after filling.
- Appropriate Signage

8.0 REFERENCES

1. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
2. Information Notices on Diagnosis of Occupational Diseases, Head Occupational Health and Hygiene Unit, Public Health and safety at work Directorate, European Commission Luxemburg 1994.
3. Handbook of Industrial Toxicology Plunkett, Industrial Health Services, Barberton, Ohio, Hyden 1987.
4. Tse, RL et al Nitrogen Dioxide Toxicity: Report of Four Cases in Firemen, Journ. Am. Med. Assn., 1970:212-1431.
5. Olson KR Poisoning & Drug Overdose by the faculty, staff and associates of the California Poison Control system, A Lang Clinical Manual, 1999.

31. PESTICIDES (ORGANOPHOSPHATES ONLY)

1.0 Physicochemical properties

There are hundreds of preparations of organophosphate (OP) compounds. The properties vary according to the compositions of active and inactive ingredients.

PEL 8hr TWA depends upon the type of **organophosphate**

Route of absorption: Skin and eye are the most common route of absorption in agriculture.

Special Note: Organophosphates (OP) can be readily absorbed through the skin.
Lungs.
Gastrointestinal.

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Horticulture- gardeners, greenhouse workers
- Agriculture -garden pest control operators, farmers
- Vector control operators
- Formulation (and manufacture of organophosphates e.g. Insecticide sprays
- Laboratory workers analysing Organophosphates
- Packing and redistribution of Organophosphates.

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECT

Onset is prompt but may be delayed up to 12 hours. OP and their potent sulfoxidation

("-oxon") derivatives inhibit the acetylcholin-esterse, allowing the accumulation of excessive acetylcholine. Permanent damage to the acetylcholinesterse, enzyme (aging) may occur after a variable delay unless antidotal treatment with an enzyme reactivator is given.

Some OP (e.g. disulfoton, fenthion, others) are highly lipophilic and are stored in fat tissue, which may lead to delayed and persistent toxicity for several days after exposure.

Generally effects are not apparent until the activity of this enzyme is 30% of the normal.

Central Nervous System:

Anxiety, dizziness, headache, sleeplessness, confusion, coma, convulsions.

Respiratory:

Dyspnoea, chest tightness, bronchospasm, bronchial hypersecretion, pulmonary oedema.

Gastrointestinal:

Salivation, nausea, vomiting, abdominal colic, diarrhoea, pancreatitis.

- **Ocular**: Lacryimation, miosis, blurring of vision
- **Muscular:** fasciculation, cramps

3.2 CHRONIC POISONING

Non-specific:

- Headache, quick onset of fatigue
- Disturbed sleep, anorexia

Central and Autonomic Nervous System

- Nystagmus, tremors
- Failing memory, disorientation

Peripheral Nervous System:

- Paresis
- Neuritis
- Paralysis

Note: OP is commonly used in the field. For the list of OP used in Malaysia please refer to Booklet-List of Pesticides registered with the Pesticide Board, Department of Agriculture.

Examples are the Basudin 60 Dichlorvos Dimethoate Dipterex Diazinon DDVP (2,2, Dichlorovinyl 0, O-Dimethyl Phosphate) Fenthion, Malathion, Parathion, and Tamaron.

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any occupational exposure to OP.

BIOLOGICAL EXPOSURE DETERMINANTS

Determinants	Sampling Time	BEI
Cholinesterase activity in red cells (confirmatory)	Discretionay	70% of indivi-dual's baseline
Cholinesterase activity in plasma (Screening)		70% of individual 's baseline

Source: TLVs & BEIs ACGIH 2000

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with particular emphasis on the:

- Central and autonomic nervous system.
- Plasma cholinesterase estimation is good enough for medical surveillance.

However for treatment purposes, Red blood cell acetyl cholinesterase (rbc ACHE) estimation (venous blood in heparinised container and should be sent immediately to the laboratory in an ice box).

4.2 PERIODIC MEDICAL EXAMINATIONS (6 MONTHLY)

Clinical examination including plasma ACHE estimation.

4.3 WHEN INDICATED THE FOLLOWING TEST MAY BE CONDUCTED

Plasma cholinesterase estimation should be carried out (especially following accidental skin contact or acute high exposures or in suspected acute poisoning cases).

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning and excessive absorption.
- Cases with plasma ACHE of less than 50% of the pre-employment or laboratory's normal level.

- Cases with rbc ACHE of less than 50% of the pre-employment or laboratory's normal level.
- Cases with rbc ACHE of between 50 and 70% of the pre-employment level showing a fall of more than 10% in their repeat test results.

All cases of MRP and suspected cases of OP poisoning/excessive absorption must be notified to the DG (DOSH).

Note:

(a) Suspension includes suspension from work with carbamates.

(b) Where the pre-employment level is not available, use the lower limit of the laboratory as normal range as a baseline forcomparison or previous results: whichever is higher.

6.0 FOLLOW-UP ACTION

Repeat tests.

6.1 ABNORMAL RESULTS

If the plasma ACHE level is between 50 and 70% of the pre- employment level, a repeat test should be done one month later. A fall in the plasma ACHE level of more than 10% in the repeat test should be investigated to exclude poisoning.

6.2 MEDICALLY REMOVED WORKERS & RETURN TO WORK

- All suspended cases should have repeat plasma ACHE estimations at monthly intervals. The worker may return to work with organophosphates and/or carbamates when the plasma ACHE has returned to more than 70% of the pre-employment level.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to organophosphates.

6.3 TREATMENT

Treatment with atropine and/or 2-PAM (2-pyridine-aldoxine methiodide) may be considered especially if there are clinical signs and symptoms.

7.0 PREVENTIVE MEASURES

- Pesticide application course for all the pesticide applicators,
- Approved Personal Protective equipment
- Appropriate signage

8.0 REFERENCES

1 National Institute for Occupational Safety and Health: Criteria for a recommended standard (Occupational exposure to Malathion). US Department of Health, Education and Welfare, 1976: 92-107, 141-145.

2 Medical Supervision of Pesticide Workers -Guidelines for Physicians. State of California, Department of Health, Epidemiological Studies Laboratory, 1974.

3 Namba T: Cholinesterase Inhibition by Organophosphorus Compounds and

its Clinical Effects. Bull. WId Hlth Org. 1974: 44: 289-307.

4 Medved LI, Kagan Ju S: Pesticides, organophosphorus. In: Safety, International Labour Office, 1983: Vo12: 1637-46.

5 World Health Organisation: Recommended Health-based Limits in occupational exposed to pesticides - Report of a WHO Study Group 1 Technical Report Series 677, Geneva, 1982.

6 American Conference of Governmental Industrial Hygienists: Organophosphorus Cholinesterase Inhibitors In: Documentation of the Threshold Limit Values and Biological Exposure Indices, 1999.

7 Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1997.

32 & 33. PITCH ,TAR, BITUMEN & CREOSOTE

1.0 SYNONYMS : Coal tar pitch, black oil

Physicochemical properties. Thick dark bituminous mixture: tarry odour

PEL 8hr TWA: 0

Route of entry

Inhalation, ingestion, skin

2.0 OCCUPATIONS AT RISK OF EXPOSURE

These substances look alike and can be used for similar purposes.

- Manufacture of tar, pitch, bitumen and creosote
- Water proofing of wood, making of roofing and insulating materials
- Lining irrigation canals and reservoirs
- Road surfacing
- Lubricant for die moulds
- Manufacture of dyestuff
- Manufacture of paints
- Chemical feedstock for the production of benzene, toluene, xylene, phenol
- Sealing agents e.g. in battery manufacture

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Skin burns
- Eyes -blepharoconjunctivitis, keratitis

3.2 CHRONIC EFFECTS

Skin & mucous membranes:

- Irritation erythema, burning, itching, followed by desquamation (aggravated by sunlight)
- Pigmentation changes - hyperpigmentation (primarily forearms, wrists, hands, scrotum)
- Follicular dermatitis (comedones, acne, sebaceous cysts)

- Benign neoplasms -coarsening and hardening (shagreen appearance), kerato-acanthoma, tar warts or papillomata (Tar warts may be pre-malignant)
- Malignant neoplasms -epithelioma (usually after 20 years of exposure. Common sites are head, neck, scrotum and upper limbs)

Respiratory:

- Irritation -congestion, pneumonitis
- Squamous cell and/or oat cell carcinoma (evidence still uncertain)
- (Due to residues of coal tar distillation; 3-4-benzpyrene, 1,2,5,6-dibenzanthracene)

Gastrointestinal tract:

- Burning pain
- Diarrhoea

Carcinogenic products of carbonaceous materials may be present in may substances : - pitch, coal tars, bitumen, heavy tar oils, soot, creosote oil and shale oil and its distillation and fractionation products.

In these complex mixtures, polycyclic aromatic hydrocarbon are probably the actual carcinogens.

4.0 MEDICAL SURVEILLANCE PRGRAMME

Any occupational exposure to pitch, tar, bitumen and creosote.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data, with particular emphasis on the:

- ♦ Skin (pre-cancerous lesions) and lungs.
- ♦ Creasote in urine (diagnostic test)

4.2 PERIODIC MEDICAL EXAMINATIONS

Regular skin examination, of the skin annually ensures early detection of re-cancerous lesions and their treatment before cancer can develop. But frequency will depend on exposure levels and symptoms and signs.

5.0 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- ♦ CXR
- ♦ Skin biopsies

6.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- ♦ All cases with pre-malignant lesions and definite or suspected benign/malignant neoplasms of the skin and lungs.

All cases recommended for MRP and suspected cases of benign/malignant neoplasms related to tar, pitch, bitumen, and creosote must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Cases with evidence of abnormal clinical findings should be investigated with a view to confirming the diagnosis.

6.1 ABNORMAL RESULTS

Repeat tests

6.2 MEDICALLY REMOVED WORKERS & RETURN TO WORK

- ❖ All medically removed workers should have repeat investigations and relevant biochemical tests within one month.
- ❖ The worker should not return to work until the signs and symptoms and abnormal cytology/ biochemical results have disappeared.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to pitch, tar, bitumen & creosote.

7.0 PREVENTIVE MEASURES

- ❑ Workers at risk should be made aware of the dangers of the substances they are handling
- ❑ The employer should be encouraged to examine their skin regularly and report any suspicious lesions to the OHD.
- ❑ Appropriate signage

8.0 REFEERNCES

1 International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 3rd edition, p 569-570, 198-200, 1983: 2147-2149.

2 International Agency for Research on Cancer. Annual Report, World Health Organisation, 1983: 39.

3 Risk of Cancer from the use of Tar, Bitumen in Road Works. Br J Ind M.ed, 46:1,24-30, 1989. 6.14.3.

4 Control of Substances Hazardous to Health (COSHH) Regulations 11- Health Surveillance- carbonaceous agents associated with skin cancers in HSF, 1989.

34. VINYL CHLORIDE MONOMER (VCM)

1.0 SYNONYMS: Cholroethylene

PEL 8hr TWA: 1 ppm

Route of entry

Inhalation, skin

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- ➢ (Production of polyvinyl chloride resins (workers who clean and maintain the reactors are especially at risk)
- ➢ Storage of VCM
- ➢ Sampling and analysis of VCM

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Non-specific manifestations e.g. headache, giddiness, disorientation.
- May progress to loss of consciousness.
- Lung irritation
- Skin irritation

3.2 CHRONIC EFFECTS

- Raynaud' s phenomenon
- Scleroderma-like lesions
- Acro-osteolysis (especially of the hands)
- Liver and/or spleen fibrosis
- Lung fibrosis
- Pancytopenia

- **Others**
- Angiosarcoma of the liver

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any occupational exposure to VCM.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline data with special attention to detecting pre-existing abnormalities of the liver, spleen, skin and circulation to extremities (hands.)

- ♦ Liver function tests (Serum bilirubin, alkaline phosphatase, alanine and aspartate transaminases and gamma-glutamyl transpeptidase estimations)
- ♦ Pulmonary Function Test

Worker should abstain from alcohol at least 1 week prior to undergoing the liver function tests.

4.2 PERIODIC MEDICAL EXAMINATIONS

Should cover the same areas as the pre-employment examination**.** An annual check is appropriate.

4.3 WHERE INDICATED, THE FOLLOWING TESTS MAY BE DONE

- ♦ Ultrasound
- ♦ Liver Scan
- ♦ Hand X -ray, to obtain baseline evidence of the state of the finger bones
- ♦ Chest X-ray
- ♦ Liver biopsy
- ♦ Platelet count
- ♦ Hepatitis screening

5.0 INDICATIONS MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected VCM diseases
- Workers with the following conditions: -
- Persistent liver abnormalities (one or more abnormal result in the liver function test on at least 2 occasions within a 1 month period).
- Clinical evidence of liver disease e.g. enlarged spleen, liver, spider naevi, etc.

All cases recommended for MRP and suspected cases of VCM diseases must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTION

Repeat tests.

6.1 ABNORMAL LFT RESULTS (one or more parameters)

Cases with abnormal liver function test results should be investigated to exclude effects due to VCM. Please refer to the algorithm on page 3 (ALGORITHM FOR THE INVESTIGATION OF ABNORMAL LIVER FUNCTION TEST RESULTS).

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- ❖ All suspended cases should be followed up.
- ❖ All removed cases should have repeat liver function test at 3 monthly intervals.
- ❖ The worker may return to work with VCM when the liver function results return to normal and he is clinically asymptomatic.
- ❖ Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to vinyl chloride.

7.0 PREVENTIVE MEASURES

- ❑ Improvement in work-process & workplace hygiene Adequate ventilation
- ❑ Personal Protective equipment. Chemical goggles
- ❑ Workers should be advised to abstain from alcohol
- ❑ Appropriate signage

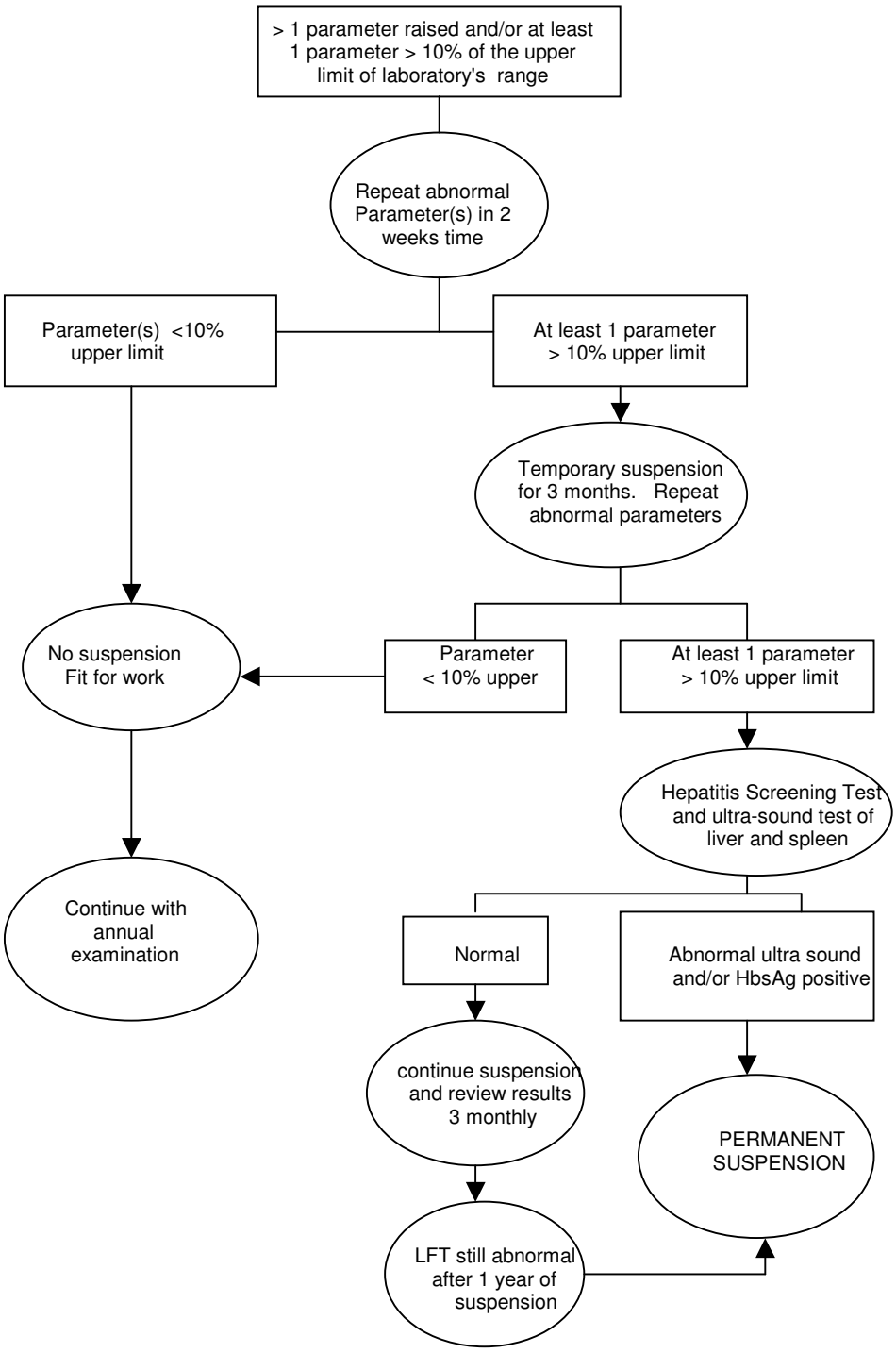
8.0 REFERENCES

1. International Labour Office: Encyclopaedia of Occupational Health and Safety Vol II, -2258, 1983: 22:56.
2. National Institute for Occupational Safety and Health: Technical Information. A cross-sectional epidemiological survey of vinyl chloride workers. U.S. Department of Health, Education and Welfare1977: No 77:177.
3. Makk, L; et al: Liver damage and Angiosarcoma in vinyl chloride workers -A systematic detection program. Journal of the American Medical Association, 1974.
4. Smulevich, *'V* .B, I. V Fedotova, V .S. Filatova: Increasing evidence of the rise of cancer in workers exposed to vinyl chloride. Br J Ind Med, 1988,45:2; 93-7.
5. Reinl, W H. Weber: Status of epidemiological research of vinyl chloride disease. ZeIJltralblatt fur Arbeitsmedizin Arbeitsschutz and Prophylaxe, 197:497- 104.
6. Roland S E Chong .An update on Occupational Liver Disease. J Occup Medicine, Vol 2, No 2, July 1990:44-9.
7. Donald S Herip: Recommendations for the investigation of abnormal hepatic function in asymptomatic workers. Am J Ind Medicine, 21: 1992: 331-9.

8. Phoon WH, Magdalene Chan, Ho SF, Dept of Industrial Health Guidelines For Designated Factory Doctors-The Factories (Medical Examinations) Regulations Dept of Community, Occupational and Family medicine National University of Singapore 1997:36.1-361-5.

9. Control of Substances Hazardous to Health (COSHH) Regulations: Regulation 11-Health Surveillance-Vinyl chloride in The Health and Safety Factbook Health & safety Executive, Professional Publishing Ltd London, 1989:1/9.

ALOGRITHM FOR THE INVESTIGATION OF ABNORMAL LIVER FUNCTION TEST RESULTS



35. NICKEL SULFIDE ROASTING, FUME AND DUST AS NICKEL

1.0 SYNONYMS: Nickel nitrate, nickel sulphate

PEL 8hr TWA

Nickel

Soluble compounds, as Ni 0.1 mg/m3

Nickel subsulfide. as Ni 0.1 mg/m3

Elemental/Metal 1.5 mg/m3

Insoluble compounds, as Ni 0.2 mg/m3

Physicochemical properties

Nickel is a lustrous, grey white (silvery) metal metal, which is ductile, malleable, and with a fibrous structure

Compounds crystals and powders

All forms are odourless

- Manufacture of nickel cadmium batteries
- Welding
- Pewter articles manufacture
- Coin and kitchen utensil manufacture

Route of Absorption

Inhalation

Dermal

2.0 OCCUPATIONS AT RISK OF EXPOSURE

- Alloys, catalyst
- Ceramics
- Electrolytic nickel-plating
- Mining and extraction of nickel

3.0 TOXIC EFFECTS

3.1 ACUTE EFFECTS

- Fumes highly irritating to the respiratory tract.
- Metal fume fever

3.2 CHRONIC EFFECTS

- Severe dermatitis and eczema via sensitisation
- Sensitisation is **permanent**
- "Nickel itch" upon repeated exposure. Pink papular erythema of webs of fingers, which may spread to other parts of body. Pustulation and ulceration may occur. " Nickel itch" usually clears in one week.
- Anosmia

Some compounds are human nasal and lung carcinogens (IARC 1)

- Carcinoma of nasal sinuses and lung after chronic exposure to dusts and fumes in the refining processes
- Asthma
- Skin senzitiser and irritant

4.0 MEDICAL SURVEILLANCE PROGRAMME

Any work where workers are exposed to levels of airborne levels which are liable to be in excess of half the -in-air standard and or where there is significant risk of ingesting it.

4.1 PRE-PLACEMENT MEDICAL EXAMINATIONS

Clinical examination and baseline with particular attention to:

- Skin- Patch test for nickel for nickel in sensitisation
- Nasal sinuses
- Chest X-Ray
- Increased nickel in urine Health Safety Executive UK,
- **Urine Nickel in the unexposed is 1-10nmol/mmol creatinine**.
- There is NO **Biological Exposure Index (BEI)** for Nickel

Relative contraindications are individuals with diseases of skin, sinuses and lung.

4.2 PERIODIC MEDICAL EXAMINATIONS

As for pre-employment, periodic examination for

- Urine nickel.

5.0 INDICATIONS FOR MEDICAL REMOVAL PROTECTION

- All cases of definite or suspected poisoning/ disease and excessive absorption.

All cases recommended for suspension and suspected cases of poisoning / excessive absorption must be notified to the DG (DOSH).

6.0 FOLLOW-UP ACTIONS

6.1 ABNORMAL RESULTS

If abnormal urine cytology, symptoms & signs persist, a repeat test must be done immediately.

Refer to urologist for abnormal cytology.

6.2 MEDICALLY REMOVED WORKER & RETURN TO WORK

- All suspended cases should have repeat investigation urine examinations and relevant biochemical tests where indicated and should not return to work until the signs and symptoms and abnormal biochemical results have disappeared.
- Recommend the worker for return to work when the workplace hygiene is safe and healthy and does not place the worker at increased risk of material impairment to health from exposure to chemical hazardous to health.

6.3 TREATMENT

- All cases of poisoning must be immediately removed from exposure and referred for hospital treatment.
- Wash contaminated areas of body with soap and water.
- Suggest the use of dimercaprol

7.0 PREVENTIVE MEASURES

- Improvement in work-process
- Prompt attention to all cutaneous wounds
- Workplace hygiene, Adequate ventilation
- Approved Personal Protective equipment. Chemical goggles.
- Appropriate signage

9.0 REFERENCES

12. Olson KR Poisoning & Drug overdose, A Lang clinical manual, Prenctice-Hall Int, Inc 1999: 498t.
13. Plunkett E R Handbook of Industrial toxicology, Industrial Health Services Barberton, Ohio. 288 1987:287.
14. International Labour Office: Encyclopaedia of Occupational Health and Safety, Geneva, 4th edition, 1998.
15. Rom MN Environmental & occupational medicine 2nd Edition Little Brown & Co. Boston, Toronto, London 1992.
16. Information notices on Diagnosis of occupational diseases Nickel and its compounds European Commission 1994:38.

USECHH 1

OCCUPATIONAL MEDICAL SURVEILLANCE PROGRAMME

RECORD BOOK

Occupational Safety and Health
(Use and Standards of Exposure of Chemicals Hazardous to Health)
Regulations 2000

Department of Occupational Safety & Health

Ministry of Human Resources

This document is confidential. A copy must be kept by the employee and one by Occupational Health Doctor. When a change in the Occupational Health Doctor occurs this document must be produced to the next Occupational Health Doctor. It must be produced to the Occupational Health Doctor whenever the employee comes for medical examination

Please write clearly

A. GENERAL INFORMATION

Name of worker _____

Address _____

_____

District _____ State _____ Post-Code ☐☐☐☐☐

Home Tel No. ☐☐☐ ☐☐☐☐☐☐☐☐

IC No. ☐☐☐☐☐☐ ☐☐ ☐☐☐☐ Age ☐☐ years

SOSCO No. ☐☐☐☐☐

Worksman's Compensation No. ☐☐☐☐☐☐☐

Work Permit No. ☐☐☐☐☐☐☐

Sex ☐ Male ☐ Female

Status ☐ Single ☐ Married

No. of child ☐☐

No. of years married ☐☐ years

Ethnic ☐ Malay ☐ Chinese ☐ Indian ☐ Others (specify) _____

Nationality ☐ Malaysian Citiven ☐ non Citiven (specify) _____

Next of kind to be contacted in case of emergency

Name _____

Relationship _____

Address _____

_____

Tel. No. ☐☐☐ ☐☐☐☐☐☐☐☐

Name Of Employer _____

Employer Address _____

_____

_____

Tel No. ☐☐☐ ☐☐☐☐☐☐☐☐

Fax/e-mail ☐☐☐☐☐☐☐☐☐☐

Name of officer at workplace to be contacted for further investigation

_____

Position : _____ Tel. No. ☐☐☐☐☐☐☐☐☐☐

Fax/e-mail ☐☐☐☐☐☐☐☐☐☐

Please answer the following questions
Do you have any history of or suffering from the following conditions?

Smoker		No. of years smoked	
Non smoker		No. of cigeratte/day	
Stopped smoking			

	Medical condition	Y	N	If yes (specify)
1	Eye problem (including difficulty to see at night)			
2	Fits or convulsion of any kind			
3	Serious head injury			
4	Giddiness/severe headache/migrane			
5	Fainting attacks			
6	Major brain surgery			
7	Stroke with residual disabiity			
8	Diabetes mellitus on insulin			
9	Mental illness (stress)			
10	Alcohol abuse in the last five years			
11	Drug abuse in the last five years			
12	Deformity or disability of the limbs/spine			
13	Heart disease/Hypertension/Palpitation			
14	Breathlessness/Haemoptysis/Chronic cough			
15	Hearing problem			
16	Chronic Kidney disease			
17	Are you on any regular medication at present?			Name of medicine
18	Do you have any other injury or illness not mentioned above?			

This is to certify that the above statement are true. I give consent to the OHD for Medical Examination to communicate with the management regarding my work capability after discussion with me.

Witnesses by Doctor **Signature by :**

Date:

(Name of Doctor)

B. PAST MEDICAL HISTORY (to be filled by Doctor)				
	System	Y	N	If yes (specify)
1	Central Nervous System			
2	Peripheral Nervous System			
3	Cardiovascular System			
4	Respiratory System			
5	Gastrointestinal			
6	Musculoskeletal			
7	Endocrine/Metabolic			
8	Genitourinary			
9	Reproductive			
10	H/o allergy			
11	Previous Hospitalization			
12	H/o previous occupational diseases/injuries			
13	Amount compensation paid			
14	Have any of your co-workers experienced Occ.			
	diseases/poison/injury			
15	Other health problem or injuries			

C. MENSTRUAL HISTORY (FEMALE ONLY)

☐☐ Age of menarche

☐ Regular Menses
☐ Irregular Menses

Outcome of pregnancy

No. of abortions ☐☐ specify _____
No. of stillbirth ☐☐ specify _____

D. FAMILY HISTORY

		Y	N	*If yes (specify)*
1	H/o Medical illeness			
2	H/o alllergy			
3	H/o Congential malformation			
4	Other illness			

E. OCCUPATIONAL HISTORY

		Past	Present
1	Job titles and duties		
2	Type/level of hazard		
3	Duration of employment		
4	have you received training for this job		
5	other job-other than this job		

F. PRESENT CHEMICAL HISTORY AND EXPOSURE

The Employer must present the Chemical Health Risk Assessment Report to the OHD who will analyse it before conducting Medical Examination

		Y	N	*If yes, Explain*
1	Are you trained to recognise the **symptoms and signs** of disease & poisoning due to chemical used in the work place?			
2	Do you have symptoms of signs disease due to hazardous chemical used?			
3	When (date) did you have the symptoms?			
4	Are the PPE used approved by DOSH?			
5	Has exposure monitoring t been conducted for chemicals for which the worker is exposed?			(specify the name of the chemical) Personal exposure result: 8 hour time weighed average _____ Maximum exposure limit _____ Workplace monitoring: _____

G. PHYSICAL EXAMINATION

1 Anthopometry :

Weight		Kg
Height		cm
BMI		

* BM result
<20 - underweight
20-25 Ideal weight
25-30 Overweight
>30-Obesity

Blood Pressure

Pulse

2 General appearance _____

Eye	Right	
Vision		
Field vision		
Colour vision		
Fundoscopy		

Ear	Right	Left
External canal		
Ear drum		
Air conduction		
Bone conduction		

Nose
Throat _____
Lymphatics _____
Nails _____
Vericose vein _____
Skin _____

3 Central Nervous system
Orientation to time, place and person _____
Others _____

4 Cardio vascular system
Auscultation
DRNM _____
Others _____

5 Respiratory system
Chest expension _____
Air entry _____
Crepitations _____
Wheeze _____
Others _____

6 Gastrointestinal system
Liver _____
Spleen _____
Abdomen _____
Others _____

7 Genitourinary
Kidney _____
Bladder _____
Uterus _____
Others _____

8 Musculoskeletal
Lower Limbs

	R	L
Power		
Reflex		
Sensation		

Upper Limbs

	R	L
Power		
Reflex		
Sensation		

Others _____

H. INVESTIGATION TO BE DONE /DONE

BASELINE/PREPLACEMENT/PERIODIC/POST-EMPOYMENT
DATE:

Investigation	Result
Urine	
FEME	
Blood	
Hb	
BUSE	
Renal profile	
Liver function test	
Others (specify)	
Sputum for AFB	
CXR	
Lung function test	
FVC	
FEV1	
FEV1/FVC	
Audigram	
Immunisation status	
Other (specify)	

The implication of the above results has been explained to me by the OHD

Signature of the employee _____

Date _____

USECHH 2

(USE AND STANDARD OF EXPOSURE OF CHEMICALS HAZARDOUS TO HEALTH) REGULATIONS 2000

EMPLOYEE
MEDICAL RECORD BOOK

(Company Logo)

Name : .....

Date of Medical Examination	Result of Biological Monitoring	Fitness to Work (Fit, Further Tests Needed)	Name of OHD, DOSH Reg. No.
11.2.2001	Blood lead Level 50 mg/dl		Dr. ..... JKKP IH 127/171-1( )

USECHH 3

Occupational Safety and Health Act 1994
(Act 514)

Occupational Safety and Health (Use and Standard of Exposure of Chemicals Hazardous to Health) Regulations 2000

CERTIFICATE OF FITNESS

Name of Person examined _____

NRIC/Passport No._____ Date of Birth_____Sex_____

Name & Address of Employee

_____

_____

Examination/Tests done and the results:

I hereby certify that I have examined the abovenamed person on _____

and that he is fit/not fit for work which may expose him to _____

Remarks (if any):

_____
Signature & Date

_____
Name of Occupational Health Doctor
(in BLOCK letters)

DOSH Reg. No. _____

_____
Address of Practice

Occupational Safety & Health Act 1994 (Act 514)
Use and Standards of Exposure of Chemicals Hazardous to Health Regulations 2000

SUMMARY REPORT FOR MEDICAL SURVEILLANCE

Name of Workplace: _____
Address of Workplace: _____
Company revenue / Annual income in RM_____
Work Unit where workers are in (please✓): ☐ Production ☐ maintenance ☐ chemical / heavy metals ☐ laboratories ☐ pesticides ☐ specify others: _____

	Range	Date
Workplace exposure monitoring		
Personal exposure monitoring		
Control measures monitoring e.g. LEV		

Individual Chemical: _____
(*Use one USECHH4 form for one chemical only!)*
Chemical listed under which Schedule under USECHH2000 Regulations: _____
Date of CHRA conducted (Put not done if CHRA is not done): _____
Total number workers in that workplace: _____
Total number of exposed workers: _____
Types of test performed: _____

EXAMINATION(S) RESULTS		
	Test Performed	
	Clinical Features & Biological Monitoring	Other test (To specify): Blood/Spirometry/Urine etc
No. of workers examined		
No. of workers with normal results		
No. of workers with abnormal results (Occupational caused)		
No. of workers with abnormal results (Non-Occupational caused)		
No. of workers recommended for removal		
Continue in separate sheet if required. Please include details of abnormal examination/test results in USECHH 5ii form and Medical Removal Protection in USECHH 5i form.		

I hereby declare that all particulars given in this report are accurate to the best of my knowledge.

Name of Occupational Health Doctor: _____
OHD Registration No: _____
Name of Practice & Address: _____
Duration/Experience as Medical Practitioner (in years): _____
Tel No: _____ HP no: _____ Fax No: _____
Valid email address: _____

Date:

Signature:

Submit this form within 30 days of completion of medical surveillance to the Director General, Department of Occupational Safety and Health, Level 2, 3 & 4, Block D3, Parcel D, 62530, Putrajaya. Download this form at http://www.dosh.gov.my Please ensure all items in the form are completed. Incomplete forms will be returned.

USECHH 5i

Occupational Safety and Health Act 1994 (Act 514)
Use and Standard of Exposure of Chemicals Hazardous to Health Regulation 2000

MEDICAL REMOVAL PROTECTION

1. Name of Worker _____
2. NRIC/Passport No._____
3. Socso No. _____ 4. Date of Birth _____ 5. Sex _____
6. Name and Address of Workplace: _____
7. Date of starting employment: _____ Duration of Employment (years):_____
8. Health Hazard Present *(Use one form for one chemical)*: _____

I certify that the above named person examined by me on *(dd/mm/yy)* _____ should not continue to work a as *(designated)* _____in *(place of work)* _____ department/ section for _____months, subject to a review on *(dd/mm/yy)* _____

In the mean time, he should be given alternative work in another department / section which does not expose him to *(name of individual chemical)* _____

The reasons for my recommendations are as follows (please✓): ☐ Pregnancy ☐ Breast Feeding ☐ Abnormal Result ☐ Toxicity based on History & Physical Examination ☐ specifies others: _____

Name of OHD (in BLOCK LETTERS): _____

OHD_DOSH Registration number: _____

Practice Address: _____
_____

Email Address: _____

H/P: _____ Tel: _____ Fax: _____

_____ _____
OHD Signature Date

Note: This certificate should be completed in triplicate and the original copy forwarded to the Director General, Department of Occupational Safety and Health , Level 2, 3 & 4, Block D3, Parcel D, Federal Government Administrative Centre, 62530 Putrajaya and must include the actual results of the relevant examination/tests. The quantitative results (e.g. blood lead) the exact figures and measurements units must be clearly stated. Also include copy of qualitative results (eg Chest X-ray). Incomplete form will be returned.

USECHH 5ii

Details of workers with abnormal examination results												
No	**Employee's Name**	**NRIC/ Passport**	**Sex**		**Job category/ Designation**	**Department/ Work area**	**Hazards exposed**	**Lab tests performed**	**Results**	**Laboratory normal range**	**Existing control measures**	**Recommendations / action taken eg MRP, Referal to specialist, follow up, repeat test etc**
			M	**F**								

Submit this form together with USECHH 4 form within 30 days of completion of the medical surveillance to The Director General, Department of Occupational Safety And Health, Level 2, 3, and 4, Block D3, Parcel D, Pusat Pentadbiran Kerajaan Persekutuan 62530 Putrajaya. This form can be downloaded from http://www.dosh.gov.my Continue in separate sheet if required.