

BASELINE HEALTH MONITORING BEFORE STARTING WORK IN A CREOSOTE PROCESS

Workers must be informed of the potential health effects associated with exposure to creosote. In particular, workers should be aware of the occurrence and recognition of photosensitivity and skin changes, and the need to report them to the registered medical practitioner as soon as possible, even if they occur between regular monitoring.

- 1. Collection of demographic data**
- 2. Work history**
- 3. Medical history**
- 4. Physical examination**

A physical examination will be conducted, with emphasis on the neurological system. A thorough examination of all skin will also be conducted, including the scrotum, noting any abnormal lesions, in particular, squamous cell carcinoma and hyperkeratosis. These should be recorded on a body outline form showing both front and back views and noting size.

DURING EXPOSURE TO A CREOSOTE PROCESS

5. Photosensitivity

Photosensitivity is a known symptom of exposure to creosote. Where workers report photosensitivity, an appointment should be arranged with the medical practitioner and workers should receive additional counselling on the potential health effects of creosote on the skin.

Where a worker is diagnosed with photosensitivity or other health effects related to exposure, the health monitoring report should recommend that the person conducting a business or undertaking must review control measures and carry out recommended remedial action.

6. Physical examination

A physical examination will be conducted annually with emphasis on the neurological system and skin. Evidence of skin sensitisation will be noted.

7. Data for inclusion in health records

Records of photosensitivity which a worker has had, indicating specific processes involved should be included in the worker's health monitoring report.

8. Assessing exposure to creosote [1]

The assessment of work-related exposure to creosote is difficult because workers are exposed to a mixture of compounds. However, polycyclic aromatic hydrocarbons (PAH) and alkylated PAHs are a significant proportion of creosote and the registered medical practitioner may choose to assess exposure to PAH through urine analysis. The metabolite of pyrene, 1-hydroxypyrene (1-HP) in urine, is most often used as the biomarker for PAH exposure as pyrene is a very thermodynamically stable compound and therefore most abundant in a PAH mixture.

Where urine analysis is performed, the following values should be considered when assessing exposure to PAH:

Biological level	Source
1 µg 1-HP/L urine	Workcover NSW Biological Occupational Exposure Limit (BOEL) Committee. <i>Note: this value is under review.</i>
< 0.3 µg 1-HP/L urine - unexposed non-smokers 0.5 µg 1-HP/L urine - median for non-exposed smokers 1 µg 1-HP/L urine (benchmark value)	American Conference of Governmental Industrial Hygienists (ACGIH)
4 µmol 1-HP/mol creatinine in urine (benchmark guidance value)	Health and Safety Executive (UK)

Where results of urine testing indicate there may be high workplace exposure to PAH (creosote), the registered medical practitioner should consider recommending:

- the worker should be removed from creosote work
- the PCBU should review control measures and carry out recommended remedial actions
- the worker must be informed of the results of the health monitoring.

Other information

Measurement of airborne levels of PAH fails to take into account the potential pathway of skin absorption, which can contribute significantly to the total internal dose. The levels of 1-hydroxypyrene in the urine can increase during the course of a workday, reaching maximum values three to nine hours after the end of exposure. If the contribution of dermal exposure is important, post-shift 1-hydroxypyrene excretion can be lower than pre-shift levels when the worker has been exposed to PAH on the day prior to sampling. The difference between beginning and end of workweek excretion gives an indication of the average exposure over the work week.

Note: Other hydroxylated metabolites of PAH have been proposed as markers of PAH exposure, however, currently correlation between metabolite levels and exposure have not been determined.

AT TERMINATION OF WORK IN A CREOSOTE PROCESS

9. Final medical examination

A final medical examination will be conducted and will include a physical examination with emphasis on the neurological system and skin, noting abnormal lesions and evidence of skin sensitisation.

10. Continuing medical monitoring

Workers with a history of skin disease due to contact with creosote should be advised to seek continuing medical monitoring.

SUPPLEMENTARY INFORMATION ON CREOSOTE

11. What is creosote?

Creosote is the name used for a variety of products that are mixtures of many chemicals. Creosotes are created by high-temperature treatment of beech and other woods (beechwood creosote) or coal (coal tar creosote). Creosote prepared from coal tar is the most common form of creosote in the workplace. Creosote is a mixture of several hundred chemicals but only a limited number are present in amounts of more than one per cent. There are six major classes of compounds in creosote: aromatic hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs) and alkylated PAHs (which can constitute up to 90 per cent of creosote); tar acids/phenolics; tar bases/nitrogen-containing heterocycles; aromatic amines; sulphur-containing heterocycles; and oxygen-containing heterocycles, including dibenzofurans. Generally, phenolic compounds, low-molecular-weight PAHs, and some heterocycles tend to be predominantly in the gaseous phase. Creosote constituents may also occur in the atmosphere as particulate matter.

Coal tars are by-products of the high temperature treatment of coal to produce coke or natural gas. Coal tar creosote is a distillation product of coal tar and is a thick, oily liquid that is typically amber to black in colour. Coal tar pitch is a residue produced during the distillation of coal tar and is usually thick, black or dark brown liquid or semisolid with a smoky or aromatic odour. Coal tar pitch volatiles are compounds given off from coal tar pitch when it is heated. Coal tar creosote, coal tar and coal tar pitch are mixtures of similar compounds and are rarely formed in nature.

12. Work activities that may represent a high risk exposure

Coal tar creosote is a timber preservative for use where there is a high fungal decay and termite hazard in the ground or in marine and fresh waters. Uses include marine piles, jetty bracing, sea walls, railway sleepers, power or telecommunication line poles. Work-related exposure to creosote may occur during manufacture, use, transport, or disposal of creosote or creosoted wood products. Most data are available for wood-preserving workers. Non-wood uses or sources of exposure include anti-fouling applications on concrete marine pilings, component of roofing pitch, fuel oil and a lubricant for die moulds, rubber or tyre industry, iron foundry work, steel plant work, aluminium smelters, coke or gas manufacturing plants, and clean-up of creosote contaminated sites. Other reported uses include animal and bird repellent, insecticide, animal dip and fungicide.

13. Non-work sources

Coal tar shampoos for psoriasis and anti-dandruff therapy, coal tar ointments for treatment of eczematous dermatitis and contaminated groundwater near creosote waste sites. Aquatic invertebrates and fish bioaccumulate creosote components. Transfer to the human food supply is possible via contaminated seafood.

POTENTIAL HEALTH EFFECTS FOLLOWING EXPOSURE TO CREOSOTE

14. Route of entry into the body

The routes of creosote entry into the body are through inhalation and percutaneous absorption. Accidental ingestion is unlikely unless poor hygiene and work practices allow it.

15. Target organ/effect

Skin – irritation, blistering, hyperpigmentation, warts, photosensitivity, cancer.

CNS – depression, weakness, headache, vertigo, nausea, confusion, convulsions.

Respiratory tract – irritation.

Eyes – irritation, chemical burns, corneal damage.

16. Photosensitivity

Photosensitivity is an abnormally high reactivity in the skin or eyes to ultraviolet radiation or natural sunlight. It **may** be induced by ingestion, inhalation or skin contact with certain substances known as photosensitisers. Symptoms will vary with the amount of ultraviolet radiation, type and amount of photosensitiser, skin type, and age and gender of the person exposed [2].

Photosensitisation of the skin and eyes can be caused by exposure to specific industrial chemicals. The skin can be affected by dermal exposure or inhalation. The eyes can be affected by volatile fumes. In certain occupations, the risk from exposure to particular photosensitising chemicals and solar ultraviolet radiation is severe. For example exposure to tar and sunlight can cause precancerous and cancerous skin lesions. Exposure to coal tar fumes can cause simultaneous inflammation of the conjunctiva and cornea [2].

17. Acute effects

Creosote has been involved in incidental or accidental poisoning incidents, mainly due to its use as a pesticide. Deaths occurred following ingestion of about 1 to 2 g (children) or about 7 g (adults). Symptoms included salivation, vomiting, respiratory difficulties, vertigo, headache, loss of pupillary reflexes, hypothermia, cyanosis, convulsion accompanied by oropharyngeal, intestinal, pericardial, liver and kidney damage [3].

Contact with creosote or creosote vapour may cause irritation of the skin. The skin may become red, papular, vesicular or ulcerated, depending on the period of exposure. Increased photosensitisation may occur, particularly on the face or hands. Vapours and contact can produce an intense burning of the membranes of the eyes and respiratory tract. Eye contact can lead to conjunctivitis and keratitis.

One or more of the following effects may be evident on short-term exposure to high concentrations of creosote:

- **systemic** – nausea and vomiting, diarrhoea, anorexia and difficulty in swallowing, salivation, abdominal discomfort, respiratory distress, cyanosis, pupillary changes, convulsive movements, rapid pulse or vascular collapse
- **neurological** – headaches, fainting, vertigo and mental disturbances.

18. Chronic exposure

Chronic exposure may provide sufficient absorption to show the systemic effects listed above.

19. Carcinogenicity [3]

Increased risks of developing lip and skin cancers have been observed in cohort studies of Swedish and Norwegian wood impregnators and in Finnish round timber workers. A cohort study examining 922 Swedish and Norwegian wood impregnators from 13 plants (for example railroad cross ties and telegraph poles) found a standardized incidence ratio (SIR) of 250 for lip cancers and an SIR of 237 for non-melanoma skin cancer.

The risk increased with the latency; analysis by duration of exposure was not provided. According to the authors, the significantly elevated risk for lip and skin cancer could probably be attributed to the combination of exposure to creosote and sunlight [4]. In a population-based record linkage study in Finland, elevated risks for lip cancer, SIR = 306, and non-melanoma skin cancer, SIR = 464, were found for round-timber workers [5]; the mortality for cancer of the scrotum was elevated among brick makers exposed to creosote. Prolonged skin exposure to soot and coal tar creosote has been associated with cancer of the scrotum in chimney sweeps.

Single epidemiological studies suggested a possible risk for bladder cancer, multiple myeloma, and lung cancer due to exposure to creosote. Two case-control studies suggested an increased risk of brain tumours and neuroblastoma among offspring of male workers with possible creosote exposure.

All of the epidemiological studies were based on qualitative estimations of exposure rather than on measurements. There is consistent evidence from human studies that creosote causes skin cancer, but the studies do not allow dose-response analysis.

20. Carcinogen classification¹

Creosote, from distillation of coal tar, is classified according to the GHS as Carcinogenicity Category 1B (May cause cancer).

REFERENCED DOCUMENTS

1. Lauwerys RR, Hoet P, *Industrial Chemical Exposure Guidelines for Biological Monitoring*, 3rd edition, Lewis Publishers, Boca Raton, 2001.
2. Australian Safety and Compensation Council, *Guidance Note for the Protection of Workers from the Ultraviolet Radiation in Sunlight*, Australian Safety and Compensation Council, Canberra, 2008.
3. World Health Organisation/International Program on Chemical Safety, *Concise International Chemical Assessment Documents (CICAD) 62*, WHO Geneva, 2004. www.inchem.org
4. Karlehagen S, Andersen A, Ohlson C, 'Cancer incidence among creosote-exposed workers', *Scandinavian Journal of Work, Environment and Health*, vol 18, pp 26–29, 1992.
5. Pukkala E, *Cancer Risk by Social Class and Occupation: A Survey of 109,000 Cancer Cases among Finns of Working Age*, Karger, Basel, 1995.

FURTHER READING

Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Creosote*, Agency for Toxic Substances and Disease Registry, US Department of Health & Human Services, Public Health Service, Atlanta, 2002.

International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 92: Some Non-heterocyclic Polycyclic Aromatic Hydrocarbons and Some Related Exposures*, International Agency for Research on Cancer, Lyon, 2010.

Worksafe Australia, *Occupational Diseases of the Skin*, Australian Government Publishing Service, Canberra, 1990.

■ 1 This classification information is provided on an advisory basis and is taken from the European Union's Annex VI to Regulation (EC) No 1272/2008, updated by the 1st Adaption to Technical Progress to the Regulation. Other hazard classes and categories may apply - see <http://esis.jrc.ec.europa.eu/index.php?PGM=cla>. These classifications are legally binding within the European Union.

HEALTH MONITORING REPORT CREOSOTE

This health monitoring report is a **confidential** health record and must not be disclosed to another person except in accordance with the Work Health and Safety Regulations or with the consent of the worker.

There are two sections. Complete both sections and all questions if applicable.

Section 1 is to be forwarded to the PCBU who has engaged your services. A copy of laboratory report(s) must be attached > > >

Section 2 may contain confidential information which may not be relevant to the health monitoring program being carried out. This section should be retained by the medical practitioner. Information which is required to be given to the PCBU should be summarised in part 7 of section 1.

SECTION 1 - THIS SECTION TO BE RETURNED TO THE PCBU			
1. PERSON CONDUCTING A BUSINESS OR UNDERTAKING			
Company / Organisation name:			
Site address:			
Suburb:			Postcode:
Site Tel:	Site Fax:	Contact Name:	
2. OTHER BUSINESSES OR UNDERTAKINGS ENGAGING THE WORKER			
Company / Organisation name:			
Site address:			
Suburb:			Postcode:
Site Tel:	Site Fax:	Contact Name:	
3. WORKER (✓) all relevant boxes			
Surname:		Given names:	
Date of birth: DD/MM/YYYY	Sex:	<input type="checkbox"/> Male	<input type="checkbox"/> Female
Address:			
Suburb:			Postcode:
Current Job:	Tel(H):	Mob:	
Date started employment : DD/MM/YYYY			
4. EMPLOYMENT IN CREOSOTE RISK WORK (✓) all relevant boxes			
1. <input type="checkbox"/> New to creosote work			
2. <input type="checkbox"/> New worker but not new to creosote work			
3. <input type="checkbox"/> Current worker continuing in creosote work			
4. Worked with creosote since DD/MM/YYYY			
5. Satisfactory personal hygiene (for example nail biting, frequency of hand washing)			<input type="checkbox"/> Yes <input type="checkbox"/> No
6. Risk assessment completed			<input type="checkbox"/> Yes <input type="checkbox"/> No

5. WORK ENVIRONMENT ASSESSMENT		(✓) all relevant boxes	
Date of assessment: DD/MM/YYYY			
Creosote Industry			
<input type="checkbox"/> Coal Distillation	Controls:		
<input type="checkbox"/> Timber Preservation	Wear gloves	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Rubber/Tyre Industry	Respirator use	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Pesticide/Insecticide/ Fungicides	Local exhaust ventilation	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Marine Piling Construction	Overalls / work clothing	<input type="checkbox"/> Yes	<input type="checkbox"/> No
<input type="checkbox"/> Other (specify):	Laundrying by employer	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Wash basins & showers (with hot & cold water)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Smoking or eating in workshop	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Personal hygiene:		
	Clean Shaven	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	Shower & change into clean clothes at end of shift	<input type="checkbox"/> Yes	<input type="checkbox"/> No
6. BIOLOGICAL MONITORING RESULTS Include at least the previous two test results (if available)			
Date	Tests performed	Recommended Action and/or Comment	
1. DD/MM/YYYY			
2. DD/MM/YYYY			
3. DD/MM/YYYY			
4. DD/MM/YYYY			
5. DD/MM/YYYY			
6. DD/MM/YYYY			
7. DD/MM/YYYY			
8. DD/MM/YYYY			
7. RECOMMENDATIONS (by Medical Practitioner)		(✓) all relevant boxes	
1. <input type="checkbox"/> Suitable for work with creosote			
2. <input type="checkbox"/> Counselling required			
3. <input type="checkbox"/> Review workplace controls			
4. <input type="checkbox"/> Repeat health assessment in _____ month(s) / _____ week(s)			

HEALTH MONITORING REPORT CREOSOTE

5. <input type="checkbox"/> Removal from work with creosote	On DD/MM/YYYY	
6. <input type="checkbox"/> Medical examination by Medical Practitioner	On DD/MM/YYYY	
7. <input type="checkbox"/> Fit to resume work	From DD/MM/YYYY	
8. <input type="checkbox"/> Referred to Medical Specialist (respiratory/dermatology/other):	On DD/MM/YYYY	
Specialist's name:		
Additional comments or recommendations arising from health monitoring:		
Medical Practitioner (responsible for supervising health monitoring)		
Name:	Signature	Date: DD/MM/YYYY
Tel:	Fax:	Registration Number:
Medical Practice:		
Address:		
Suburb:		Postcode:

SECTION 2 - THIS SECTION TO BE RETAINED BY THE MEDICAL PRACTITIONER		
1. PERSON CONDUCTING A BUSINESS OR UNDERTAKING		
Company / Organisation name:		
Site address:		
Suburb:		Postcode:
Site Tel:	Site Fax:	Contact Name:
2. OTHER BUSINESSES OR UNDERTAKINGS ENGAGING THE WORKER		
Company / Organisation name:		
Site address:		
Suburb:		Postcode:
Site Tel:	Site Fax:	Contact Name:
3. WORKER (✓) all relevant boxes		
Surname:		Given names:
Date of birth: DD/MM/YYYY	Sex:	<input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Pregnant/Breast Feeding?
Address:		
Suburb:		Postcode:
Current Job:	Tel(H):	Mob:
Date started employment : DD/MM/YYYY		
4. GENERAL HEALTH ASSESSMENT (if applicable)		
Symptoms of:	Comments	Further testing?
Skin disorders		<input type="checkbox"/> Yes <input type="checkbox"/> No
Headaches, dizziness		<input type="checkbox"/> Yes <input type="checkbox"/> No
Respiratory disorders		<input type="checkbox"/> Yes <input type="checkbox"/> No
Irritation of eyes, nose or throat		<input type="checkbox"/> Yes <input type="checkbox"/> No
Cough		<input type="checkbox"/> Yes <input type="checkbox"/> No
CNS		<input type="checkbox"/> Yes <input type="checkbox"/> No
Others		<input type="checkbox"/> Yes <input type="checkbox"/> No
Height ____cm Weight ____kg Bp ____/____ mmHg		<input type="checkbox"/> Yes <input type="checkbox"/> No

5. OTHER MEDICAL HISTORY, FAMILY MEDICAL HISTORY, CURRENT MEDICATION, COMMENTS, TESTS OR RECOMMENDATIONS (use separate sheet if necessary)

Medical Practitioner (responsible for supervising health monitoring)

Name:	Signature	Date: DD/MM/YYYY
Tel:	Fax:	Registration Number:
Medical Practice:		
Address:		
Suburb:		Postcode: