THALLIUM

BASELINE HEALTH MONITORING BEFORE STARTING WORK IN A THALLIUM PROCESS

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

A physical examination will be conducted only if indicated by work and medical history.

5. **Investigation**

A spot urine test for thallium will be used to test the worker's baseline exposure. The result is corrected for creatinine, that is the thallium concentration in micrograms per gram of creatinine. Where there is 50 µg thallium or more per gram creatinine, a repeat spot urine test should be performed at the same time of the day.

DURING EXPOSURE TO A THALLIUM PROCESS

6. **Monitoring exposure to thallium**

COMPARISON OF RESULTS WITH BASELINE LEVEL

A spot urine test for thallium will be conducted every 90 days and compared with the worker's baseline levels.

Where there is 50 µg thallium or more per gram of creatinine:

- a repeat spot urine for thallium should be performed at the same time of the day to confirm results
- a physical examination should be performed with particular attention to the nervous system and noting hair loss
- the person conducting a business or undertaking must review control measures and carry out recommended remedial action
- the worker must be informed of the results of the health monitoring.

Note: A spot urine for thallium should also be conducted if there is an acute exposure, for example following a reagent spill.

OTHER INFORMATION

Following absorption, thallium rapidly appears in the urine, which is the main excretory route. Excretion, however, is slow and levels may remain elevated for several weeks following exposure—half-life is between 15 to 30 days. The concentration of thallium in urine is generally below 0.83 µmol/mol creatinine (7.3 nmol/L or 1.5 µg/L). Work exposure should be below 28 µmol/mol creatinine (245 nmol/L or 50µg/L).

REMOVAL LEVEL

Where results of urine testing indicate a level of thallium in urine above 100 µg per gram of creatinine, the following action should be carried out until the level falls below 50 µg thallium per gram of creatinine:

- a repeat spot urine for thallium should be performed at the same time of the day to confirm results
- a medical examination should be performed and the registered medical practitioner should consider whether the worker should be removed from thallium work
- urine tests should be repeated every 30 days and then at regular intervals until the level of thallium in urine falls below 50 µg thallium per gram of creatinine
- the person conducting a business or undertaking should review control measures and carry out recommended remedial action
- the worker must be informed of the results of health monitoring.

RETURN TO WORK

The worker must not return to thallium work until they have been assessed as medically fit to return to work by the medical practitioner supervising the health monitoring.

AT TERMINATION OF WORK IN A THALLIUM PROCESS

7. Final Medical Examination

A final medical examination will be conducted and will include a spot urine for thallium.

SUPPLEMENTARY INFORMATION ON THALLIUM

8. Work activities that may represent a high risk exposure

Examples of work activities involving thallium and its compounds which require special attention when assessing exposure include:

- laboratory analysis where thallium malonate-formate (Clerici's reagent) is used for mineralogic analysis of rocks, ores and sand, and separation of diamonds
- production of pigments, luminous paints, artificial gems, coloured glass, and special optical glasses for lenses and prisms, electronic devices and switches
- smelters, power plants, cement factories, with a risk of exposure from cleaning fossil fuel furnaces or flues and metal machining.

Special attention should also be given to acute exposures, including reagent spills, which may occur in the above processes.

9. Non-work sources

Thallium is present in the environment as a result of natural processes and from man-made sources. It is ubiquitous in nature and occurs especially in sulphide ores of various heavy metals. Losses to the environment mainly occur from mineral smelters, coal-burning power-generating plants, brickworks and cement plants as thallium is a trace element of the raw materials. Thallium volatilises during the burning of coal or raw material for cement production and recondenses on the surface of fly-ash. Thallium enters food because it is easily taken up by plants through the roots. Cigarette smoking is also a source of thallium. People who smoke have twice as much thallium in their bodies as non-smokers.

POTENTIAL HEALTH EFFECTS FOLLOWING EXPOSURE TO THALLIUM

Pure thallium is odourless and tasteless and extremely toxic.

The relative toxicity of a thallium compound depends on its water solubility. The more water soluble forms (sulphate, acetate, malonate and carbonate) are more toxic than the less water soluble forms (sulphide and iodide).

10. Route of Entry into the Body

The routes of thallium entry into the body are through inhalation, ingestion and percutaneous absorption. Thallium and thallium salts are rapidly absorbed by intact skin, by inhalation and through the mucous membrane of the gastro-intestinal tract.

11. Target organ/effect

CNS – unco-ordination, tremors, encephalopathy, convulsions, coma, paralysis, optic nerve atrophy.

Peripheral nervous system – motor and sensory peripheral neuropathy.

Skin – alopecia.

Gastrointestinal tract – anorexia, gastroenteritis.

12. Acute Effects

Thallium and thallium compounds are extremely toxic. For adults, doses which have proved lethal vary between 6 and 40 mg/kg. Thallium behaves as a potassium analogue and is distributed in the intracellular space of most tissues. Intracellular thallium is less rapidly released than potassium.

Poisoning from industrial exposure has rarely been reported, and those cases that have been reported were not fatal.

The triad of gastroenteritis, polyneuropathy and alopecia is regarded as the classic syndrome of thallium poisoning. Following ingestion of a single toxic dose, symptoms of acute poisoning may occur within 12 hours to two days and include severe abdominal pain, vomiting, diarrhoea, gastrointestinal bleeding, tremors, delirium, convulsions, paralysis and coma leading to death in one to two days. The acute reaction may subside to be followed in 10 days by the development of polyneuritis, psychosis, delirium, optic nerve atrophy and blindness, increased heart rate and blood pressure, skin eruptions and hepatic or renal injury. Hair loss occurs within 15 to 20 days.

13. Chronic Effects

Thallium may act as a cumulative poison with chronic intoxications and a sudden release from tissue stores may lead to acute toxic symptoms.

Long-term low-level exposure may give rise to a mild clinical symptomatology (polyneuropathy and partial hair loss). At a higher exposure level, fatigue, anorexia, leg joint pain, optic nerve atrophy with visual disturbances, and ascending neuropathy may occur.

14. GHS carcinogen, germ cell mutagen and reproductive toxicant classifications[1]

The European Union has determined that thallium and thallium compounds are not classified as carcinogens, germ cell mutagens or reproductive toxicants.

FURTHER READING

Agency for Toxic Substances and Disease Registry, *ToxFAQs for Thallium*, Agency for Toxic Substances and Disease Registry, United States Department of Health and Human Services, Public Health Service, Atlanta, 1995. www.atsdr.cdc.gov/.

Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Thalllium*, Agency for Toxic Substances and Disease Registry, United States Department of Health and Human Services, Public Health Service, Atlanta, 1992.

International Programme on Chemical Safety, *Environmental Health Criteria 182: Thallium*, International Programme on Chemical Safety, World Health Organization, Geneva, 1996

Lauwerys RR, Hoet P, *Industrial Chemical Exposure Guidelines for Biological Monitoring*, 3rd Ed, Lewis Publishers, Boca Raton, 2001.

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.

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:	☐ Female	☐ Male
Address:			
Suburb:			Postcode:
Current Job:	Tel(H):		Mob:
Date started employment : DD/MM/YYYY			
4. EMPLOYMENT IN THALLIUM RISK WORK			(✓) all relevant boxes
1. ☐ New to thallium work			
2. ☐ New worker but not new to thallium work			
3. ☐ Current worker continuing in thallium work			
4. Worked with thallium since DD/MM/YYYY			

5. Satisfactory personal hygiene (for example nail biting, frequency of hand washing)		☐ Yes	☐ No
6. Risk assessment completed		☐ Yes	☐ No
5. WORK ENVIRONMENT ASSESSMENT		(✓) all relevant boxes	
Date of assessment: DD/MM/YYYY			
Thallium Industry			
☐ Laboratory Work	**Controls:**		
☐ Paint/Pigment Production	Wear gloves	☐ Yes	☐ No
☐ Glass Production	Respirator use	☐ Yes	☐ No
☐ Electronic Production	Local exhaust ventilation	☐ Yes	☐ No
☐ Power Industry	Overalls / work clothing	☐ Yes	☐ No
☐ Other (specify):	Laundering by employer	☐ Yes	☐ No
	Wash basins & showers (with hot & cold water)	☐ Yes	☐ No
	Smoking or eating in workshop	☐ Yes	☐ No
	Personal hygiene:		
	Clean Shaven	☐ Yes	☐ No
	Shower & change into clean clothes at end of shift	☐ Yes	☐ 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		

7. RECOMMENDATIONS (by Medical Practitioner)	(✓) all relevant boxes
1. ☐ Suitable for work with thallium	
2. ☐ Counselling required	
3. ☐ Review workplace controls	

4. ☐ Repeat health assessment in _____ month(s) / _____ week(s)		
5. ☐ Removal from work with thallium		On DD/MM/YYYY
6. ☐ Medical examination by Medical Practitioner		On DD/MM/YYYY
7. ☐ Fit to resume thallium risk work		From DD/MM/YYYY
8. ☐ 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: ☐Male	☐ Female ☐ 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		☐ Yes	☐ No
Headaches, dizziness		☐ Yes	☐ No
Respiratory tract		☐ Yes	☐ No
GIT		☐ Yes	☐ No
Eyes		☐ Yes	☐ No
Mucous membranes		☐ Yes	☐ No
CNS		☐ Yes	☐ No

Peripheral nervous system		☐ Yes ☐ No
Others		☐ Yes ☐ No
Height _____cm Weight _____kg Bp _____/_____ mmHg		☐ Yes ☐ 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: