# Thiocyanate salts: Human health tier II assessment

**21 April 2016**



## Chemicals in this assessment

| Chemical Name in the Inventory | CAS Number |
|---|---|
| **Thiocyanic acid, potassium salt** | 333-20-0 |
| **Thiocyanic acid, sodium salt** | 540-72-7 |
| **Thiocyanic acid, ammonium salt** | 1762-95-4 |

## Preface

This assessment was carried out by staff of the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) using the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework.

The IMAP framework addresses the human health and environmental impacts of previously unassessed industrial chemicals listed on the Australian Inventory of Chemical Substances (the Inventory).

The framework was developed with significant input from stakeholders and provides a more rapid, flexible and transparent approach for the assessment of chemicals listed on the Inventory.

Stage One of the implementation of this framework, which lasted four years from 1 July 2012, examined 3000 chemicals meeting characteristics identified by stakeholders as needing priority assessment. This included chemicals for which NICNAS already held exposure information, chemicals identified as a concern or for which regulatory action had been taken overseas, and chemicals detected in international studies analysing chemicals present in babies' umbilical cord blood.

Stage Two of IMAP began in July 2016. We are continuing to assess chemicals on the Inventory, including chemicals identified as a concern for which action has been taken overseas and chemicals that can be rapidly identified and assessed by using Stage One information. We are also continuing to publish information for chemicals on the Inventory that pose a low risk to human health or the environment or both. This work provides efficiencies and enables us to identify higher risk chemicals requiring assessment.

The IMAP framework is a science and risk-based model designed to align the assessment effort with the human health and environmental impacts of chemicals. It has three tiers of assessment, with the assessment effort increasing with each tier. The Tier I assessment is a high throughput approach using tabulated electronic data. The Tier II assessment is an evaluation of risk on a substance-by-substance or chemical category-by-category basis. Tier III assessments are conducted to address specific concerns that could not be resolved during the Tier II assessment.

These assessments are carried out by staff employed by the Australian Government Department of Health and the Australian Government Department of the Environment and Energy. The human health and environment risk assessments are conducted and published separately, using information available at the time, and may be undertaken at different tiers.

This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

For more detail on this program please visit:**www.nicnas.gov.au**

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ACRONYMS & ABBREVIATIONS

# Grouping Rationale

The chemicals in this group are known as thiocyanates or rhodanides and consist of simple inorganic salts of thiocyanic acid: sodium thiocyanate (NaSCN) (CAS No. 540-72-7), potassium thiocyanate (KSCN) (CAS No. 333-20-0), and ammonium thiocyanate ($NH_4SCN$) (CAS No. 1762-95-4). The chemicals contain the thiocyanate anion ($SCN^-$) together with common cations of low toxicological concern (NICNAS) resulting in similar physico-chemical and toxicological properties.

# Import, Manufacture and Use

## Australian

Sodium thiocyanate was reported under previous mandatory and/or voluntary calls for information as having industrial use in Australia.

## International

The following international uses have been identified through the European Union (EU) Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) dossiers; Galleria Chemica; the Substances and Preparations in Nordic countries (SPIN) database; the European Commission Cosmetic Ingredients and Substances (CosIng) database; the United States (US) Personal Care Products Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary; the Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Statement on Cyanide (ATSDR); the OECD High Production Volume chemical program (OECD HPV); the US Environmental Protection Agency's (EPA) Aggregated Computer Toxicology Resource (ACToR); the US National Library of Medicine's Hazardous Substances Data Bank (HSDB) and Household Products Database (HPDB); and World Health Organisation (WHO) Joint JECFA/FAO report (1995).

The chemicals have reported cosmetic uses, including:

- as buffering and oxidising agents in cosmetic products;

- as reducing and viscosity controlling agents;
- in antiperspirants;
- as stabilising agents; and
- in hair colouring and conditioning products.

The chemicals have reported domestic use in wood adhesives.

The chemicals have reported commercial uses, including:

- in the textile and fibre industry;
- in the metal and steel industry;
- in the oil field industry;
- in the photographic industry;
- in de-icing fluids for aeroplanes; and
- in the construction industry.

The chemicals have reported site-limited uses, including:

- as intermediates for production of metal thiocyanates;
- as additives in production of other chemicals;
- as starting materials in synthesis of dyes;
- in liquid rocket fuel;
- in production of ink for printing; and
- in production of solid-cell batteries.

The chemicals have non-industrial uses, including:

- as raw materials for production of fungicides and herbicides in the agricultural industry;
- fungicide for use on foodstuffs and ornamental flowers;
- in the nuclear power industry;
- as analytical chemicals; and
- in the pharmaceutical industry in synthesis of certain medicines.

# Restrictions

## Australian

Ammonium thiocyanate is listed in the Poison Standard (SUSMP, 2015) in Schedule 5; ‘AMMONIUM THIOCYANATE **except** in preparations containing 10 per cent or less of ammonium thiocyanate.’

Schedule 5 chemicals are labelled with 'Caution'. These are substances with a low potential for causing harm, the extent of which can be reduced through the use of appropriate packaging with simple warnings and safety directions on the label.

### International

No known restrictions have been identified.

## Existing Worker Health and Safety Controls

### Hazard Classification

The chemicals in this group are not individually listed on the Hazardous Substances Information System (HSIS). However, they are covered by a generic 'salts of thiocyanic acid' classification (Safe Work Australia) as hazardous with the following risk phrases for human health:

- Xn; R20/21/22 (acute toxicity); and
- R32 (Contact with acids liberates very toxic gas).

### Exposure Standards

#### Australian

No specific exposure standards are available.

#### International

An exposure limit of 5-10 mg/$m^3$ time weighted average (TWA) in different countries such as Ireland, Latvia, Russia and the United Kingdom has been identified (Galleria Chemica).

## Health Hazard Information

Inorganic thiocyanates are chemicals that dissociate in solution to form the thiocyanate anion ($SCN^-$) which is considered to be the main driver of toxicity associated with these chemicals. The chemicals are considered to be naturally occurring including presence in meat, dairy and plant products. The chemicals also have anthropogenic and industrial origin. The potassium, ammonium and sodium cations released upon dissociation in solution are not expected to contribute to the systemic toxicity of these chemicals (NICNAS).

### Toxicokinetics

Radioactive potassium thiocyanate (labelled at sulfur) was administered to rats (strain not specified; three animals/dose) at doses of 3.27, 4.67 or 8.14 mg/ kg bw as single intraperitoneal (i.p.) injections. About 6 hours after the injection, the majority of the thiocyanate was found in the extracellular fluid as free thiocyanate ion. Significantly higher concentrations of free thiocyanate ion were present in the thyroid with small amounts in the liver, muscle, plasma and adrenal proteins (Wood et al, 1949). No radioactivity was found in the muscle, adrenal or thyroid tissue 20 to 25 days after injection, and approximately 1-4.5 % of the injected thiocyanate sulfur was found in the urine as total sulfate. Approximately 5 % of the injected radiolabelled sulfur was excreted in the faeces (REACHa).

Thiocyanates may have goitrogenic effects due to effects on iodine transport, and also affect thyroid and plasma thyroxine levels. However in a diet supplemented with sufficient iodine, adverse effects of thiocyanates are, to a large extent, protected against (REACHc).

In oral administration studies, serum concentrations of potassium thiocyanate and sodium thiocyanate peaked at 6 hours in rabbits and remained high for 48 hours, and peaked at greater than 8 hours in dogs and remained high for 72 hours (REACHa; REACHc). In a study in healthy patients and patients with renal failure, the half-life of potassium thiocanate was determined to be 3 days and 9 days, respectively (REACHc).

## Acute Toxicity

### Oral

The chemicals are classified as hazardous with the risk phrase ‘Harmful if swallowed’ (Xn; R22) in the HSIS (Safe Work Australia). Oral median lethal dose (LD50) values of between 232 and 1180 mg/kg bw in rats, 500 and 809 mg/kg bw in mice, 500 and 600 in guinea pigs, 500 mg/kg bw in rabbits and 508 mg/kg bw in quails were reported for the chemicals in this group (REACHa; REACHb; REACHc). The available data support the current hazard classification of these chemicals.

The only available study conducted according to OECD Test Guideline (TG) 401 and compliant with Good Laboratory Practice (GLP) principles, was conducted in Japanese quails (5 animals/sex/dose). Ammonium thiocyanate was administered by oral gavage at 0, 191, 343, 617, 1111 or 2000 mg/kg bw. All animals in the 617, 1111 and 2000 mg/kg bw groups died within one hour to 2 days after the treatment. Clinical signs included fluid faeces in all animals, uncoordinated movements, lethargy, clonic spasms, abnormal head posture, ventro-lateral recumbency, hunched posture, abnormal breathing and ptosis prior to death. Histopathology showed haemorrhages in the intestines, swollen and dark red liver, dark red spleen and detached cuticles of the stomach at doses above 617 mg/kg bw. The reported LD50 was 508 mg/kg bw (REACHb).

All of the studies below were not conducted in accordance with any test guideline or were not compliant with GLP.

A study using sodium thiocyanate administered by the oral route (further information not specified) at doses of 579, 627, 675 or 724 mg/kg bw in mice and 675, 772, 868 or 965 mg/kg bw in rats reported LD50 values of 598 and 765 mg/kg bw in mice and rats, respectively. Observed sub-lethal effects were not reported (REACHa).

A study using potassium thiocyanate administered by the oral route (further information not specified) at doses of 547, 597, 647 or 697 mg/kg bw in mice and 697, 7696, 896, 995, 1095 or 1195 mg/kg bw in rats reported LD50 values of 594 and 554 mg/kg bw for mice and rats, respectively. Observed sub-lethal effects were not reported (REACHc).

### Dermal

The chemicals are classified as hazardous with the risk phrase ‘Harmful in contact with skin’ (Xn; R21) in the HSIS. While the limited available data do not support this classification, in the absence of more comprehensive information, there is insufficient evidence to support a recommendation to amend this classification.

Potassium thiocyanate was applied under occlusive conditions on the back of Wistar rats (5 animals/sex/dose) at 2000 mg/kg bw for 24 hours. All animals showed red tears (chromodacryorrhoea), erythema, necrosis and scales at the treatment site. All animals recovered between 2-3 days. No abnormalities were observed in the pathology examinations. An LD50 of > 2000 mg/kg bw/day was reported (REACHc).

### Inhalation

The chemicals are classified as hazardous with the risk phrases ‘Harmful by inhalation’ (Xn; R20) in the HSIS (Safe Work Australia). The available data are not sufficient to recommend an amendment to the existing classification.

In a non-guideline study in mammals for ammonium thiocyanate, the median lethal concentration (LC50) value was determined to be > 100 mg/$m^3$. No other study details were provided (REACHb).

Additionally, these chemicals are classified as hazardous with the risk phrase 'Contact with acids liberates very toxic gas' (Xn: R32) in the HSIS (Safe Work Australia). The chemicals have the potential to release hydrogen sulfide (CAS No. 7783-06-4) (Liler, 1979) and hydrogen cyanate (CAS No. 74-90-8) under acidic conditions.  Hydrogen sulfide and hydrogen cyanate are both classified as hazardous with the risk phrase 'Very toxic by inhalation (T+; R26)' in the HSIS (Safe Work Australia).

## Corrosion / Irritation

### Skin Irritation

The chemicals are not considered skin irritants based on the available information.

No in vivo studies are available. In two studies, both conducted in 2010, according to the then draft OECD In Vitro Skin Irritation: Reconstructed Human Epidermis (RhE) TG 439, sodium thiocyanate or ammonium thiocyanate (10 mg moistened with 5 µL water) were applied on a human skin tissue model and incubated for 42 hours. Relative tissue viability was taken as the expression of skin irritation. After 15 mins, the mean relative tissue viability was over 50 % for both test substances, and hence the chemicals were not considered to be irritating to the skin (REACHa; REACHb).

### Eye Irritation

Ammonium thiocyanate is an eye irritant, based on the available in vivo and in vitro data, warranting hazard classification. Sodium thiocyanate and potassium thiocyanate are not irritating based on the available in vitro data for sodium thiocyanate.

In a study similar to OECD TG 405 with deviations from the test method, ammonium thiocyanate was instilled into the left conjunctival sac of six New Zealand White rabbits. Three of the eyes were washed with water after an exposure period of four seconds. The average scores of effects at the 24-, 48-, and 72-hour observation periods for the non-rinsed and the rinsed eye for cornea, iris, and conjunctivae (redness & chemosis) were given as 0/0.67/0.67/1.33 and 0/0.67/2.33/2.33 respectively. The effects were not reversible within 72 hours after application (REACHb).

In two studies according to OECD TG 437 'bovine corneal opacity and permeability (BCOP) test method for identifying ocular corrosives and severe irritants' (REACHa; REACHb), sodium thiocyanate or ammonium thiocyanate were instilled in excised bovine cornea at 20% (w/w) for a duration of 240 minutes. In vitro irritancy score (IVIS) was taken as a measure of eye irritancy, with mean scores above the threshold value of 55 considered to indicate eye irritation. The application of sodium thiocyanate produced a mean IVIS of 49 and sodium thiocyanate was determined to be not an eye irritant based on the conditions of the test. (REACHa; REACHb). The mean IVIS for ammonium thiocyanate was above the threshold value, at 121, indicating potentially severe irritancy or corrosivity of the chemical (REACHa; REACHb).

## Sensitisation

### Skin Sensitisation

The chemicals are not considered to be skin sensitisers based on the negative results seen in several skin sensitisation animal studies including a guinea pig maximisation test (GPMT) and a local lymph node assay (LLNA).

The skin sensitising potential of sodium thiocyanate was investigated in a murine LLNA conducted according to OECD TG 429 in female CBA mice. Animals were dosed at 0, 10, 25 or 50 % in dimethylformamide with five animals/dose, with the reported stimulation indices (SI) at these concentrations of 1.6, 2.7, and 1.5, respectively. No EC50 value could be determined. At doses above 25 %, auricular lymph nodes were considered enlarged with no further treatment related effects reported (REACHa).

In a GPMT conducted similarly to OECD TG 406, ammonium thiocyanate was applied to Pirbright-Hartley guinea pigs (20 animals/dose) at 0 or 10 %. No animals displayed any reactions at challenge at any dose at 24 or 48 hours post-application (REACHb).

Based on the results for sodium and ammonium thiocyanate, potassium thiocyanate is not expected to cause skin sensitisation.

## Repeated Dose Toxicity

### Oral

Based on the treatment-related effects reported in various repeated dose toxicity studies, repeated oral exposure to the chemicals is not considered to cause serious damage to health.

Ammonium thiocyanate was administered to Wistar rats (10 animals/sex /dose) by oral gavage in a 90-day study in accordance with OECD TG 408. Doses were 0, 20, 100 or 500 mg/kg bw/day. A no-observed-adverse-effect-level (NOAEL) of 20 mg/kg bw/day was reported based on effects seen at 100 mg/kg bw/day and higher. Clinical signs above 100 mg/kg bw/day included hunched posture. Treatment related histopathological effects included thickening of the limiting ridge of the forestomach and slight hepatocellular hypertrophy in the liver. Treatment related haematological findings included decreased red blood cell count, and increased haemoglobin and haematocrit in females. At 500 mg/kg bw/day, mortalities occurred in five males and eight females. Clinical signs included hunched posture, piloerection with moribund animals showing lethargy, laboured respiration, diarrhoea, watery discharge from the eyes, muscle twitching/uncoordinated movements, and ventro-lateral recumbency. Treatment related histopathological findings included slight lymphoid hyperplasia in the spleen and moderate to severe atrophy in the thymus and bone marrow. Enlarged spleen and reduced thymus weight in addition to slight seminiferous epithelial degeneration in the testes were also reported. Haematological findings included reduced total white blood cell count and decreased haemoglobin and mean corpuscular haemoglobin concentration in males. Due to clinical signs of morbidity including reduced body weight gain and mortalities, the remaining animals at the highest dose were sacrificed at day 60 (REACHb). Effects on the thyroid, a known target organ for thiocyanates, were not considered toxicologically significant. This includes a significant change in the relative thyriod weight in females only at 20 mg/kg bw/day group only.

Further studies were of low detail including a 12 week study in rats (strain not specified) administered up to 200 mg/kg bw/day sodium thiocyanate or potassium thiocyanate for 12 weeks (REACHa). In another study, 11 dogs were given potassium thiocyanate at doses between 20 and 110 mg/kg bw/day, with the top three doses being reduced to 21 mg/kg bw/day halfway through the study, or, between 23 and 105 mg/kg bw/day sodium thiocyanate. The animals dosed above 100 mg/kg bw/day resulted in progressive loss of weight, apathy, head-droop, ataxia and death. In both studies, thyroid effects were not reported (REACHa; REACHc).

Several investigations which examined the specific organ toxicity of the chemicals to the thyroid are available. Treatment-related increase in lesions in the thyroid were observed in goats administered potassium thiocyanate twice daily by oral gavage at a dose of 4.5 mg/kg bw/day for 30 days (REACHc). Hypothyroidism was observed in pigs fed potassium thiocyanate in the diet at 1000 - 2000 mg/kg bw/day for 119 days, but only in animals that did not receive supplemented iodine in the diet (REACHc);

### Dermal

No data are available.

### Inhalation

No data are available.

### Observation in humans

Thiocyanates have a pharmacological history of use as an antihypertensive agent and gained popularity in the early 1900s, but were consequently prohibited for this use due to adverse effects reported following misuse (Garvin, 1939). Common reported signs from therapeutic misuse include vertigo and uncomfortable weakness of the arms and legs (muscular fatigue), and enlargement of the thyroid with higher doses leading to development of mental effects including disorientation, confusion, delirium, hallucinations, convulsions and ultimately coma and death (Garvin,1939; Grayson, 1957).

The lowest reported dosage resulting in human mortality was 9.77 g delivered over 15 days, with death ensuing up to 19 days of discontinued drug use. Cases of intentional poisoning reported similar signs including cyanosis, sweating, vomiting, diarrhoea, generalised myoclonic jerks, coma and death (Legras, 1996), and toxic psychosis with extreme cerebral agitation, delirium and death (Garvin,1939).

## Genotoxicity

Based on the available studies, the chemicals are not considered to be genotoxic in vitro. No in vivo studies are available.

Several in vitro tests for the chemicals were negative with and without metabolic activation, including;

Ammonium thiocyanate (REACHb);

- bacterial reverse mutation test in *Salmonella typhimurium* strains TA98, TA100, TA1535, TA1537 and TA1538 at concentrations of up to 5000 µg/ plate.

Sodium thiocyanate (REACHa);

- mammalian chromosomal aberration test conducted according to OECD TG 473 in human lymphocytes at concentrations of up to 811 µg/mL; and
- mammalian cell gene assay conducted according to OECD TG 476 in mouse lymphoma cells at concentrations of up to 811 µg/mL.

### Carcinogenicity

Based on the limited available data, the chemicals have low potential for carcinogenicity.

In a non-guideline study, the carcinogenic potential of sodium thiocyanate was examined along with co-dosing of the test substance with sodium nitrite to determine if the mechanism of action was reliant on the formation of nitrosamines. Doses of 0.32 % sodium thiocyanate (250 mg/kg bw/day) with and without 0.2 % sodium nitrite in drinking water for 112 weeks were administered to F344 rats (20 animals/sex/dose). The test substance did not produce a significant carcinogenic effect when compared to historical controls for either the sodium thiocyanate or the sodium thiocyanate plus sodium nitrite groups (Lijinsky, 1989).

In another non-guideline 26 week study, 0.5% potassium thiocyanate was administered in drinking water to male F344 rats (30 animals/ dose) to examine possible tumour promoting effects on the thyroid. No treatment-related increases in the incidence of thyroid lesions or thyroid weight were observed (Kanno 1990; REACHc).

### Reproductive and Developmental Toxicity

The reproductive and developmental toxicity data available for potassium thiocyanate (REACHa; REACHb; Sundari 2007) suggest a mechanism for possible developmental toxicity from thyroid effects seen in the offspring. These effects can be attributed to the treatment related deficiency on iodine transport. Reporting of effects are limited to the goitrogenic effects, which limits the relevance of the studies for this endpoint.

In a previously described 90-day study, reproductive effects at 500 mg/kg bw/day ammonium thiocyanate in male rats included slight seminiferous epithelial degeneration in the testes (see **Repeat Dose Toxicity**).

### Other Health Effects

#### Endocrine Disruption

Information reported above indicates that the thiocyate ion affects iodine transport to the thyroid, resultant in possible thyroxine-mediated toxicity. However, these effects only occur at high doses and are reversible given iodine supplementation.

## Risk Characterisation

### Critical Health Effects

The critical health effects for risk characterisation include systemic acute effects including acute toxicity from oral, dermal, and inhalation exposure. Ammonium thiocyanate can also cause harmful effects including eye irritation. Under conditions of iodine

deficiency, thyroxine-mediated effects may be seen at high doses.

### Public Risk Characterisation

Ammonium thiocyanate is currently listed in Schedule 5 of the SUSMP for preparations at concentrations greater than 10 %. A number of warning statements, first aid instructions and safety directions apply. The current controls are considered adequate to minimise the risk to public health posed by domestic and cosmetic products containing ammonium thiocyanate; therefore, the chemical is not considered to pose an unreasonable risk to public health.

Currently, there are no restrictions in Australia on using sodium thiocyanate or potassium thiocyanate in cosmetics or domestic products. Although the public could be exposed to these chemicals through potential cosmetic and domestic uses, given the low hazard of the chemicals, they are not considered to pose an unreasonable risk to public health.

### Occupational Risk Characterisation

During product formulation, oral, dermal, inhalation and ocular exposure might occur, particularly where manual or open processes are used. These could include transfer and blending activities, quality control analysis, and cleaning and maintaining equipment. Worker exposure to the chemicals at lower concentrations could also occur while using formulated products containing the chemicals. The level and route of exposure will vary depending on the method of application and work practices employed.

Given the critical systemic acute health effects, the chemicals could pose an unreasonable risk to workers unless adequate control measures to minimise dermal and ocular exposure are implemented. The chemicals should be appropriately classified and labelled to ensure that a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) has adequate information to determine the appropriate controls.

The data available support an amendment to the hazard classification in the HSIS (Safe Work Australia) (refer to **Recommendation** section).

## NICNAS Recommendation

Assessment of these chemicals is considered to be sufficient, provided that the recommended amendment to the classification is adopted, and labelling and all other requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

### Regulatory Control

#### Public Health

Products containing the chemicals should be labelled in accordance with state and territory legislation (SUSMP, 2016).

#### Work Health and Safety

The chemicals are recommended for classification and labelling under the current approved criteria and adopted GHS as below. This assessment does not consider classification of physical and environmental hazards.

The hazard classification 'Irritating to the eyes' (R36) is applicable to ammonium thiocyanate only.

| Hazard | Approved Criteria (HSIS)[a] | GHS Classification (HCIS)[b] |
|---|---|---|

| Hazard | Approved Criteria (HSIS)[a] | GHS Classification (HCIS)[b] |
|---|---|---|
| Acute Toxicity | Harmful if swallowed (Xn; R22)* Harmful in contact with skin (Xn; R21)* Harmful by inhalation (Xn; R20)* Contact with acids liberates very toxic gas (R32)* | Harmful if swallowed - Cat. 4 (H302) Harmful in contact with skin - Cat. 4 (H312) Harmful if inhaled - Cat. 4 (H332) Contact with acid liberates very toxic gas (AUH032) |
| Irritation / Corrosivity | Irritating to eyes (Xi; R36) | Causes serious eye irritation - Cat. 2A (H319) |

[a] Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)].

[b] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) United Nations, 2009. Third Edition.

[*] Existing Hazard Classification. No change recommended to this classification

## Advice for consumers

Products containing the chemicals should be used according to the instructions on the label.

## Advice for industry

***Control measures***

Control measures to minimise the risk from oral, dermal, inhalation, and ocular exposure to the chemicals should be implemented in accordance with the hierarchy of controls. Approaches to minimise risk include substitution, isolation and engineering controls. Measures required to eliminate, or minimise risk arising from storing, handling and using a hazardous chemical depend on the physical form and the manner in which the chemicals are used. Examples of control measures that could minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- minimising manual processes and work tasks through automating processes;
- work procedures that minimise splashes and spills;
- regularly cleaning equipment and work areas; and
- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemicals.

Guidance on managing risks from hazardous chemicals are provided in the *Managing risks of hazardous chemicals in the workplace—Code of practice* available on the Safe Work Australia website.

Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

***Obligations under workplace health and safety legislation***

Information in this report should be taken into account to help meet obligations under workplace health and safety legislation as adopted by the relevant state or territory. This includes, but is not limited to:

- ensuring that hazardous chemicals are correctly classified and labelled;

- ensuring that (material) safety data sheets ((M)SDS) containing accurate information about the hazards (relating to both health hazards and physicochemical (physical) hazards) of the chemical are prepared; and
- managing risks arising from storing, handling and using a hazardous chemical.

Your work health and safety regulator should be contacted for information on the work health and safety laws in your jurisdiction.

Information on how to prepare an (M)SDS and how to label containers of hazardous chemicals are provided in relevant codes of practice such as the *Preparation of safety data sheets for hazardous chemicals—Code of practice* and *Labelling of workplace hazardous chemicals—Code of practice*, respectively. These codes of practice are available from the Safe Work Australia website.

A review of the physical hazards of these chemicals has not been undertaken as part of this assessment.

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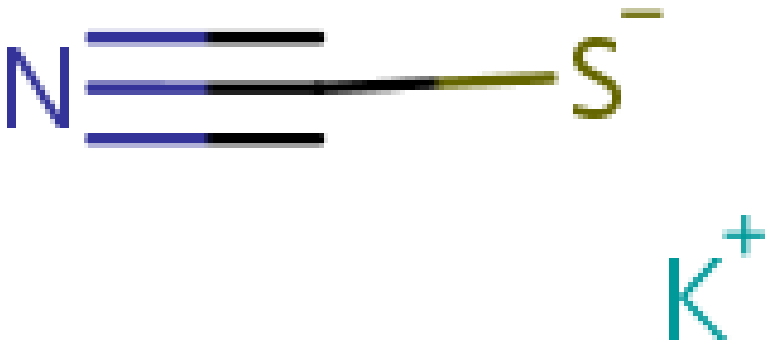
Last Update 21 April 2016

## Chemical Identities

| | |
|---|---|
| Chemical Name in the Inventory and Synonyms | **Thiocyanic acid, potassium salt**<br>potassium thiocyanate<br>potassium isothiocyanate<br>potassium rhodanide<br>potassium sulfocyanate |
| CAS Number | 333-20-0 |
| Structural Formula | |

| | |
|---|---|
| |  |
| Molecular Formula | CHNS.K |
| Molecular Weight | 97.182 |

| | |
|---|---|
| Chemical Name in the Inventory and Synonyms | **Thiocyanic acid, sodium salt**<br>sodium thiocyanate<br>sodium isothiocyanate<br>sodium rhodanide<br>sodium sulfocyanate |
| CAS Number | 540-72-7 |
| Structural Formula | |

| | |
|---|---|
| |  |
| Molecular Formula | CHNS.Na |
| Molecular Weight | 81.0 |

| | |
|---|---|
| Chemical Name in the Inventory and Synonyms | **Thiocyanic acid, ammonium salt**<br>ammonium thiocyanate<br>ammonium isothiocyanate<br>ammonium rhodanide<br>ammonium sulfocyanate |
| CAS Number | 1762-95-4 |
| Structural Formula | |

| | |
|---|---|
| |  |
| Molecular Formula | CHNS.H3N |
| Molecular Weight | 76.1226 |

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