Nickel nitrate and nickel fluoride: Human health tier II assessment

07 February 2014

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Nickel fluoride (NiF2)	10028-18-9
Nitric acid, nickel(2+) salt	13138-45-9
Nitric acid, nickel(2+) salt, hexahydrate	13478-00-7
Nickel fluoride (NiF2), tetrahydrate	13940-83-5

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**

Disclaimer

ACRONYMS & ABBREVIATIONS

Grouping Rationale

This group consists of soluble nickel chemicals; nickel fluoride, nickel nitrate and their respective tetrahydrate and hexahydrate salts. Soluble nickel salts produce the $(Ni[H_2O]_6)^{2+}$ ion in aqueous solution regardless of the nominal salt (Cotton et al, 1999; Lascelles et al, 2005) and therefore the chemicals may be grouped together for risk assessment purposes. Additional research (Henderson et al, 2012; Goodman et al, 2009) has highlighted the importance of bioaccessibility of nickel ions in different biological fluids (gastric fluid, interstitial fluid and sweat). This group of nickel chemicals has similar bioaccessibility and bioavailability; that is, these nickel chemicals release the Ni (II) ion into biological fluids at similar rates (Henderson et al, 2012; Goodman et al, 2009) and, therefore, can be assessed collectively.

Considering that nickel sulfate and nickel chloride have similar bioaccessibility and bioavailability in biological fluids to chemicals in this group, data available for nickel sulfate and nickel chloride can be "read across" when data are lacking for the chemicals in this group.

Import, Manufacture and Use

Australian

No specific Australian use, import, or manufacturing information has been identified.

International

The following international uses have been identified through European Union Registration, Evaluation and Authorisation of Chemicals (REACH) dossiers; Galleria Chemica; Substances and Preparations in the Nordic countries (SPIN) database and the US National Library of Medicine's Hazardous Substances Data Bank (HSDB).

All chemicals in this group have the following common uses:

The chemicals have reported commercial use including in:

- colourants, dyes and pigments.

The chemicals have reported site-limited use including as:

- laboratory reagents;
- electroplating agents;
- chemical mediators (catalysts, accelerators, initiators); and
- chemical intermediates.

Nitric acid, nickel (2+) salt (CAS No. 13138-45-9) is specifically used (site-limited) in the manufacture of nickel - cadmium batteries.

Restrictions

Australian

Nickel and its compounds are listed in Schedule 10 (prohibited carcinogens, restricted carcinogens and restricted hazardous chemicals) of the Work Health and Safety Regulations (WHS, 2011) for restricted use in abrasive blasting at a concentration of greater than 0.1 % nickel.

International

REACH Regulations Annex XVII Section 27 on nickel and its compounds states:

"1. Shall not be used:

(a) in all post assemblies which are inserted into pierced ears and other pierced parts of the human body unless the rate of nickel release from such post assemblies is less than 0.2 μg/cm^2/week (migration limit);

(b) in articles intended to come into direct and prolonged contact with the skin such as:

- earrings,
- necklaces, bracelets and chains, anklets, finger rings,
- wrist-watch cases, watch straps and tighteners,
- rivet buttons, tighteners, rivets, zippers and metal marks, when these are used in garments,
- if the rate of nickel release from the parts of these articles coming into direct and prolonged contact with the skin is greater than 0.5 μg/cm^2/week;

(c) in articles such as those listed in point (b) where these have a non-nickel coating unless such coating is sufficient to ensure that the rate of nickel released from those parts of such articles coming into direct and prolonged contact with the skin will not exceed 0.5 μg/cm^2/week for a period of at least two years of normal use of the article.

2. Articles which are the subject of paragraph 1, shall not be placed on the market unless they conform to the requirements set out in those points.

3. The standards adopted by the European Committee for Standardisation (CEN) shall be used as the test methods for demonstrating the conformity of articles to paragraphs 1 and 2" (REACH Annex XVII, 2009).

Existing Worker Health and Safety Controls

Hazard Classification

Nickel nitrate is classified as hazardous, with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia):

Carc. Cat. 1; R49 (Carcinogenicity)

Muta. Cat. 3; R68 (Genotoxicity)

Repr. Cat. 2; R61 (Reproductive toxicity)

Xn; R20/22 (Acute toxicity)

T; R48/23 (Repeated dose toxicity)

Xi; R38/41 (Irritation)

R42/43 (Sensitisation)

Exposure Standards

Australian

The chemicals in this group fall under the category of 'Nickel, soluble compounds (as Ni)' in HSIS, and have an exposure standard of 0.1 mg/m^3 time weighted average (TWA) (HSIS).

International

The following exposure standards are identified for this group of chemicals (Galleria Chemica):

An exposure limit (TWA) of 0.05 - 1 mg/m^3 in different countries such as USA (in various states), Canada (in various provinces), Norway (0.05 mg/m^3), Greece (1 mg/m^3), Philippines (1 mg/m^3) and Switzerland (0.05 mg/m^3).

Health Hazard Information

There are limited data for chemicals of this group. Specifically, data available for acute toxicity and irritation are presented below. There are no/or limited data available for respiratory and skin sensitisation, repeated dose toxicity, genotoxicity, carcinogenicity and reproductive & developmental toxicity. In the absence of further toxicological data for this group of chemicals, data available for nickel sulfate and nickel chloride will be used. Nickel sulfate and nickel chloride have a similar hazard profile to other soluble nickel compounds due to their similar bioaccessibility and bioavailability in biological fluids (Oller et al, 1999; Henderson et al, 2012). Soluble nickel compounds assessed (nickel chloride and nickel sulfate) are currently classified for carcinogenicity, genotoxicity and developmental toxicity. In addition, soluble nickel compounds are classified for acute toxicity by the oral and inhalation route of exposure, skin and respiratory sensitisation and skin

irritation. Also, soluble nickel compounds are classified for repeat dose toxicity via inhalation. The available data for nickel sulfate (NICNASa) and nickel chloride (NICNASb) support an amendment to the classification for the group of chemicals considered in this assessment (refer to **recommendation section**).

Toxicokinetics

Nickel compounds can be absorbed via inhalation, ingestion and to a limited extent following dermal exposure. The absorption of nickel compounds and the release of the nickel ion is dependent on the solubility of the compound in the specified physiological solutions (gastric or interstitial). Physiologically, nickel is metabolised extracellulary through a series of ligand exchange reactions and binds albumin proteins in the blood, which is consistent across humans, rats and bovine species (ATSDR, 2005).

The toxicokinetics of the chemicals in this group have not been studied extensively. A study reported in the European Union Risk Assessment Report (EU RAR) for nickel dinitrate (CAS No. 13138-45-9) described a single administration of 10 mg of nickel nitrate in starch solution by gavage to male Wistar rats. Absorption was reported as 34 % (EU RARa, 2008). No further details are reported.

With limited toxicokinetics data on this group of chemicals data from other soluble nickel chemicals, such as nickel sulfate hexahydrate (CAS No. 10101-97-0), could be considered and summarised below.

Inhalation exposure:

The deposition of inhaled nickel particles is dependent on particle size. Large particles (5 - 30 µm) are generally deposited in the nasopharyngeal area whereas smaller particles (1 - 5 µm) can enter the trachea and bronchiolar region. Even smaller particles (< 1 µm), can enter the alveolar region of the lungs (ATSDR, 2005). In humans, the ATSDR (2005) reported that 20 - 35 % of inhaled nickel that is deposited in the lungs is absorbed in the blood. The remainder of nickel is either swallowed, expectorated or remains in the respiratory tract. However, the EURAR (2008) reported that absorption of soluble nickel compounds is as high as 97 - 99 %.

A repeat dose inhalation study conducted in rats (Fischer 344) and mice (B6C3F1) showed that nickel sulfate hexahydrate (CAS No. 10101-97-0) with a mean mass median aerodynamic diameter (MMAD) ranging from 2.0 - 2.4 µm was extensively cleared from the lung. The average half life for clearance was 2 - 3 days in rats with 99 % clearance, and less than one day in mice with 80 - 90 % clearance (EU RAR, 2008). Repeated administration for two or six months did not affect the rate of clearance, and there was no reported accumulation of nickel in the lungs of rats or mice (EU RAR, 2008).

Oral exposure:

The extent of absorption from the gastrointestinal tract is influenced by the solubility of the nickel compound, whether the nickel compound is administered in drinking water, to fasting subjects, or together with food (EURAR, 2008). A human study using radiolabelled nickel isotopes given in water has indicated that approximately 29 % of the administered dose is absorbed after fasting. One vegetarian female subject had an absorption rate of 40 %, which the authors stated was possibly due to iron deficiency (Patriarca et al., 1997). In humans, absorption of nickel sulfate is 40 times greater when administered under fasting conditions via drinking water (27 %) in contrast to when administered with food (0.7 %) (ATSDR, 2005). A biokinetic model to estimate nickel absorption has shown that estimated nickel absorption ranged from 12-27 % of the ingested dose after fasting and an absorption of 1-6 % when nickel was administered either in food, in water, or in a capsule during (or in close proximity to) a meal (EURAR, 2008). Studies in rats and dogs indicate that 1 - 10 % of nickel sulfate is absorbed through the gastrointestinal tract. In animal studies, nickel was primarily distributed in the kidneys, with significant amounts also in the liver, heart, lungs and fat. Unabsorbed nickel sulfate was excreted in faeces (ATSDR, 2005).

Dermal exposure:

Human studies using radioactive isotopes of nickel applied through occluded skin patches showed that 55 - 77 % can be absorbed; however, it could not be established what percentage of nickel penetrated the deep layers of the skin or blood (ATSDR, 2005). However, further studies reported in the European Union Risk Assessment Report (EU RAR) indicate that dermal absorption of nickel sulfate and other soluble nickel compounds is extremely low (2 %). In an in vitro study using human skin, 97 % of the administered dose was present in the application solution 96 hours after application, 1 % in the receptor fluid and 0.6 % in the upper layers of the skin (stratum corneum), indicating that absorption was minimal (EU RAR, 2008).

Acute Toxicity

Oral

Nickel nitrate is classified as hazardous with the risk phrase ‘Harmful if swallowed’ (Xn; R22) in HSIS (Safe Work Australia). Based on available data and using read-across principles (OECD, 2007), this hazard classification (Xn; R22) is supported for all chemicals in this group.

Limited acute toxicity data are available for nickel nitrate. The oral median lethal dose (LD50) values in male Wistar rats exposed to nickel nitrate hexahydrate is reported as 1620 mg/kg bw. However, this study is reported as not following OECD test guidelines (EU RAR, 2008). For nickel fluoride, a study conducted similarly to OECD test guideline (TG) 425 in female Sprague Dawley (SD) rats reported a LD50 value of 310.2 mg/kg for nickel fluoride tetrahydrate (REACH). Similarly, Henderson et al. (2012) reported a LD50 value of 310 mg/kg bw for nickel difluoride tetrahydrate (Henderson et al, 2012).

Dermal

No data are available.

Reports on nickel compounds (EU RAR, 2008; ATSDR, 2005) indicate that dermal absorption is expected to be very limited (ATSDR, 2005) and, therefore, acute dermal toxicity has not been evaluated.

Inhalation

Nickel nitrate is classified as hazardous with the risk phrase ‘Harmful by inhalation’ (Xn; R20). There are no specific data to evaluate this classification. However, data from the assessments of nickel sulfate and nickel chloride can be read-across to chemicals of this group given that the chemicals in this group have similar bioaccessibility and bioavailability to nickel sulfate (Goodman et al, 2009; Oller et al., 2009; Henderson et al, 2012). The available data on nickel sulfate and nickel chloride (NICNASa; NICNASb) therefore support the exisiting classification for nickel nitrate.

Corrosion / Irritation

Skin Irritation

The chemicals in this group are skin irritants. Nickel nitrate is classified as hazardous with the risk phrase 'Irritating to skin' (Xi; R38) in HSIS (Safe Work Australia). The available data support this hazard classification. The available data for nickel fluoride warrant its hazard classification (refer to recommendation section).

Three skin irritation sudies carried out similarly to OECD TG 404 are reported in the EU RAR (EU RAR, 2008). Three different formulations of nickel nitrate were utilised; dry crystalline nickel nitrate hexahydrate (20.1 % Ni), crystalline nickel nitrate hexahydrate (19.9 % Ni) and a commercial nickel nitrate solution (14 % Ni, pH 3.9). All three studies conducted in New Zealand White rabbits resulted in skin irritation characterised by erythema (grading scores of 2.8 - 3.1) and oedema (grading scores of 1.0 - 2.2) (EU RAR, 2008). In a further study, nickel nitrate hexahydrate on unabraded rabbit skin produced moderate to severe erythema and severe oedema after 24 hours. After 3 - 8 days, the exposed areas were free of oedema and erythema. The skin was completely healthy in two animals within 13 days. However, in one animal, the formation of a crust was still present at the end of the observation period (15 days) (REACHa).

For nickel fluoride, a study was conducted according to OECD TG 404 in New Zealand White rabbits. Nickel fluoride tetrahydrate was applied as a dry paste (75 % w/w mixture in distilled water) in a semi-occlusive manner. After four hours of exposure, erythema and moderate oedema within an hour of patch removal were reported. All animals were free of irritation by the end of the seven day observation period (REACHb)

Eye Irritation

Nickel nitrate is classified as hazardous with the risk phrase ‘Risk of serious eye damage’ (Xi; R41) in HSIS (Safe Work Australia). Based on the available data on nickel nitrate and nickel flouride, this classification is supported for all chemicals in this group.

In an eye irritation study conducted similarly to OECD TG 405, 0.1 g of nickel nitrate hexahydrate was instilled into the eyes of New Zealand White rabbits. This chemical was found to be highly irritating with corneal opacity, chemosis, iritis and conjunctivitis observed within 24 - 72 hours and did not fully resolve at the end of observation period (REACHa). A white discharge was also noted after 24 hours which did not completely resolve by the end of the observation period. In addition, two other studies on the chemical provided similar results with eye effects not fully reversible within the observation period (REACHa; EU RAR, 2008).

For nickel fluoride, an eye irritation study was conducted according to OECD TG 405. Nickel fluoride tetrahydrate (0.09 g) was instilled into the eyes of New Zealand White rabbits. This chemical was found to be highly irritating with corneal opacity, chemosis, iritis and conjunctivitis observed at 24 - 72 hours and did not resolve at the end of the observation period (21 days). In addition, a white discharge was noted after 24 hours, which did not resolve within the observation period (REACHb).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation include systemic long-term effects (genotoxicity and developmental toxicity), local long-term effects (carcinogenicity), local and systemic acute effects (acute toxicity by the oral and inhalation routes of exposure) and local acute effects (skin and respiratory sensitisation). The chemical may also cause harmful effects on the respiratory tract following repeated exposure through inhalation, and skin and eye irritation.

Public Risk Characterisation

The chemicals in this group have no identified uses in Australia. Overseas, the chemicals have mainly site-limited uses. Therefore, it is unlikely that the public will be exposed to chemicals in this group. Although, the public may come into contact with articles/coated surfaces containing the chemical, it is expected that the chemical will be bound within the article/coated surface and hence will not be bioavailable. Therefore, the risk to the public is not considered to be unreasonable.

Occupational Risk Characterisation

Based on overseas use, it is possible that the chemicals of this group may be used for electroplating, as chemical mediators and chemical intermediates. During use of the chemicals in electroplating, dermal, ocular and inhalation exposure of workers to these chemicals may occur, particularly where manual or open processes are used. These may include transfer and blending activities, quality control analysis, and cleaning and maintenance of equipment. Worker exposure to the chemicals at lower concentrations may 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 long-term, local long-term and systemic acute/local health effects, these chemicals may pose an unreasonable risk to workers unless adequate control measures to minimise dermal, ocular and inhalation exposure to the chemicals 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 appropriate controls.

The data available support an amendment to the hazard classification in HSIS (refer to **Recommendation section**). However, based on available data on nickel sulfate hexahydrate from animal studies, there is a concern that the current occupational exposure standard (0.1 mg Ni/m^3 - inhalable fraction) for 'Nickel, soluble compounds (as Ni)' in HSIS may not be sufficiently protective of the health of workers. A concentration of 0.25 mg/m^3 nickel sulfate hexahydrate (CAS No. 10101-97-0) (equivalent to 0.06 mg Ni/m^3) was identified in the inhalation repeated dose toxicity studies as a level at which severe effects are observed. The Scientific Committee on Occupational Exposure Limits (SCOEL) in the EU proposed a lowering of the exposure standard to 0.01 mg Ni/m^3 (TWA - inhalable fraction) for water soluble and poorly water soluble nickel compounds, excluding metallic nickel (SCOEL, 2011). The differences between rats and humans with respect to particle deposition in the alveolar region should be considered and quantified in considering an exposure standard (SCOEL, 2011).

While the pH of 5 % w/v nickel nitrate has been measured as 5, commercial nickel nitrate has been reported to produce solutions with a pH as low as 1.5 due to residual nitric acid (EU RAR, 2008). The commercial product should additionally be classified according to the concentration of nitric acid.

NICNAS Recommendation

A Tier III assessment may be necessary to provide further information as to whether the current exposure controls are appropriate to offer adequate protection to workers.

All other risks are considered to have been sufficiently assessed at the Tier II level, subject to implementing any risk management recommendations, and provided that all requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

Regulatory Control

Public Health

It is recommended that the existing SUSMP classification for nickel sulfate be altered to "Nickel, soluble salts" as it is likely that for any publicly available products containing nickel sulfate, other soluble nickel compounds including chemicals in this group could be substituted.

Work Health and Safety

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

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Harmful if swallowed (Xn; R22) Harmful by inhalation (Xn; R20)	Harmful if swallowed - Cat. 4 (H302) Harmful if inhaled - Cat. 4 (H332)
Irritation / Corrosivity	Risk of serious eye damage (Xi; R41) Irritating to skin (Xi; R38)	Causes serious eye damage - Cat. 1 (H318) Causes skin irritation - Cat. 2 (H315)
Sensitisation	May cause sensitisation by inhalation (Xn, R42) May cause sensitisation by skin contact (Xi; R43)	May cause allergy or asthma symptoms or breathing difficulties if inhaled - Cat. 1 (H334) May cause an allergic skin reaction - Cat. 1 (H317)
Repeat Dose Toxicity	Toxic: danger of serious damage to health by prolonged exposure through inhalation (T; R48/23)	Causes damage to organs through prolonged or repeated exposure through inhalation - Cat. 1 (H372)
Genotoxicity	Muta. Cat 3 - Possible risk of irreversible effects (Xn; R68)	Suspected of causing genetic defects - Cat. 2 (H341)
Carcinogenicity	Carc. Cat 1 - May cause cancer by inhalation (T; R49)	May cause cancer - Cat. 1A (H350i)
Reproductive and Developmental Toxicity	Repro. Cat 2 - May cause harm to the unborn child (T; R61)	May damage the unborn child - Cat. 1B (H360D)

[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 industry

Control measures

Control measures to minimise the risk from inhalation exposure to nickel chloride 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 chemical is used. Examples of control measures which may minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- using local exhaust ventilation to prevent the chemical from entering the breathing zone of any worker;
- health monitoring for any worker who is at risk of exposure to the chemical if valid techniques are available to monitor the effect on the worker's health;
- air monitoring to ensure control measures in place are working effectively and continue to do so;
- 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 chemical.

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 assist with meeting 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 the chemical has not been undertaken as part of this assessment.

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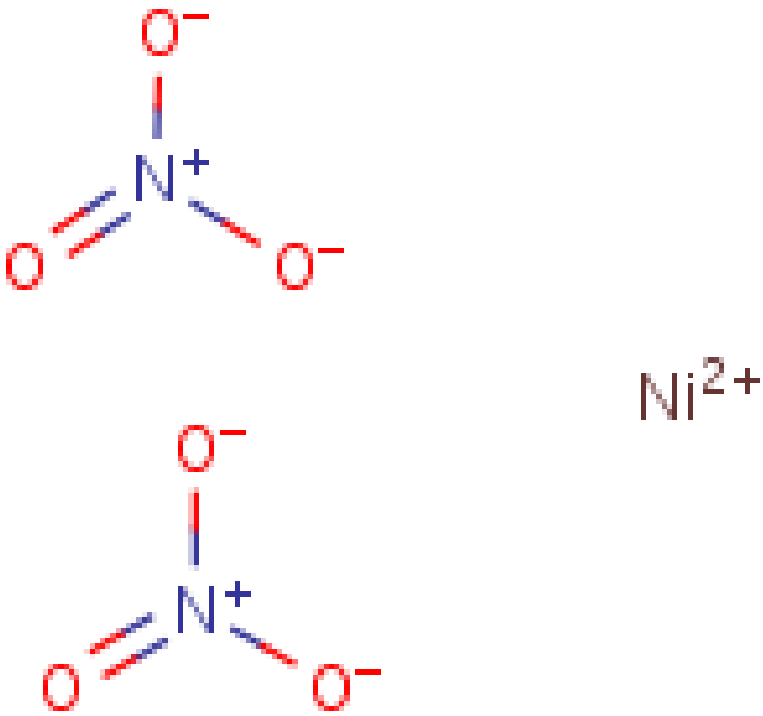
Last Update 07 February 2014

Chemical Identities

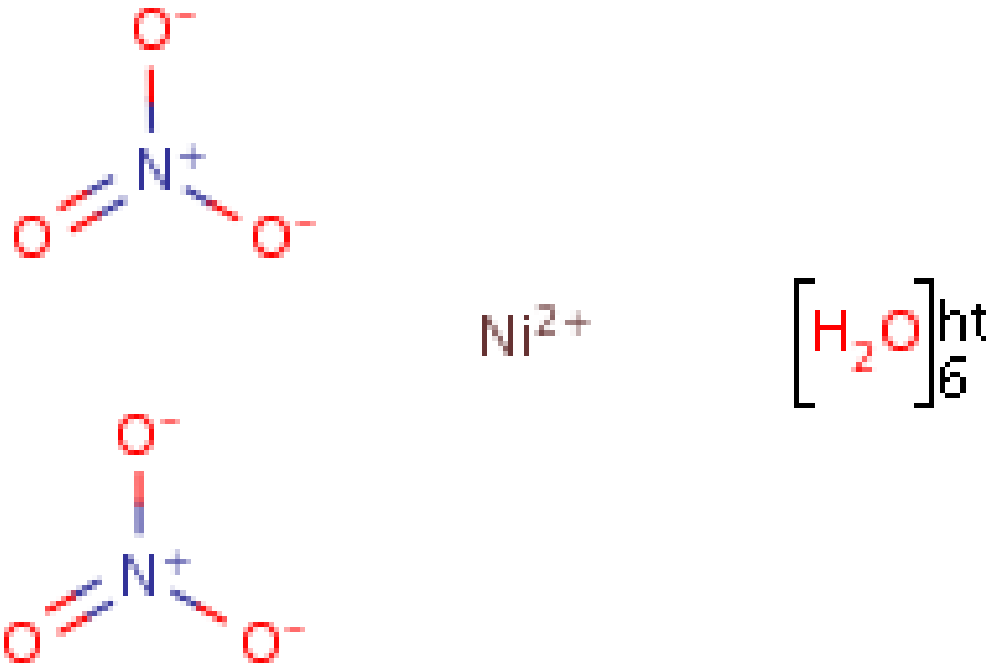
Chemical Name in the Inventory and Synonyms	**Nickel fluoride (NiF2)** Nickel difluoride Nickel(II) fluoride (1:2) Nickelous fluoride
CAS Number	10028-18-9
Structural Formula	

	
Molecular Formula	F2Ni
Molecular Weight	96.69

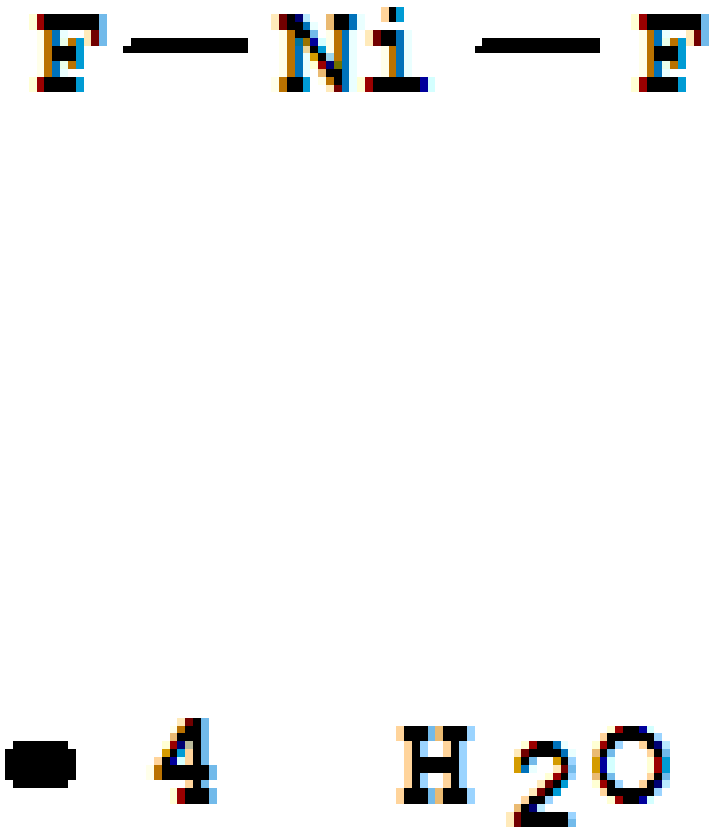
Chemical Name in the Inventory and Synonyms	**Nitric acid, nickel(2+) salt** Nickel nitrate Nitric acid, nickel(2+) salt Nickel (II) nitrate Nickel bis (nitrate) Nickel dinitrate
CAS Number	13138-45-9
Structural Formula	

	
Molecular Formula	HNO3.1/2Ni
Molecular Weight	182.7

Chemical Name in the Inventory and Synonyms	**Nitric acid, nickel(2+) salt, hexahydrate** Nickel dinitrate, hexahydrate Nickel nitrate, hexahydrate Nickelous nitrate, hexahydrate Nickelous nitrate hexahydrate Nickel nitrate (Ni(NO3)2) hydrate (1:6)
CAS Number	13478-00-7
Structural Formula	

	
Molecular Formula	H2O.1/3HNO3.1/6Ni
Molecular Weight	290.79

Chemical Name in the Inventory and Synonyms	**Nickel fluoride (NiF2), tetrahydrate** Nickel difluoride tetrahydrate
CAS Number	13940-83-5
Structural Formula	

	
Molecular Formula	F2Ni.4H2O
Molecular Weight	168.75

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