

1st Stakeholder Consultation – Compilation of initial substance information for nickel sulphate (CAS 7786-81-4; EC 232-104-9) and nickel sulfamate (CAS 13770-89-3; EC 237-396-1)

Abbreviations

CLP	Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging
ECHA	European Chemical Agency
PACT	Public Activities Coordination Tool
REACH	Regulation (EU) No 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemical substances
RMOA	Risk Management Option Analysis
SVHC	Substances of Very High Concern
BOELV	Binding Occupational Exposure Limit Value
OEL	Occupational Exposure Limit

1. Legal status and other restrictions

Both nickel salts, nickel sulphate and nickel sulfamate, are classified under the CLP regulation (Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging) as follows: ¹

Table 1: Harmonized classification according to CLP of nickel sulphate and nickel sulfamate

	Nickel sulphate	Nickel sulfamate
Human Health	Carc. 1A - H350i Muta. 2 - H341 Repr. 1B - H360D STOT RE 1 - H372 Acute Tox. 4 - H332 Acute Tox. 4 - H302 Skin Irrit. 2 - H315 Resp. Sens. 1 - H334 Skin Sens. 1 - H317	Carc. 1A - H350i Muta. 2 - H341 Repr. 1B - H360D STOT RE 1 - H372 Resp. Sens. 1 - H334 Skin Sens. 1 - H317
Environment	Aquatic Acute 1 - H400 Aquatic Chronic 1 - H410	Aquatic Acute 1 - H400 Aquatic Chronic 1 - H410

Source: Annex VI to CLP; <https://echa.europa.eu/de/information-on-chemicals/annex-vi-to-clp>

¹ <https://echa.europa.eu/de/information-on-chemicals/annex-vi-to-clp>, last viewed 19.04.2018

The restrictions for substances under entry 28 and entry 30 of REACH Annex XVII apply for nickel sulphate and nickel sulfamate, and prohibit the supply to the general public of each of the listed substances: as a substance, as a mixtures or as a constituent of other mixtures.

Nickel and its compounds are subject to a number of legal restrictions:

- Nickel and its compounds are subject to the restriction entry 27 of REACH Annex XVII, which restricts the use in post assemblies and articles coming into direct and prolonged contact with the skin.²
- The IED Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) sets emission limit values for nickel and its compounds at industrial sites.³
- In the Water Framework Directive 2006/11/EC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community, nickel is listed as a substance for which water pollution has to be reduced. Member States are required to establish environmental quality standards for this purpose.
- A maximum level for nickel is set for water intended for human consumption by the Council Directive 98/83/EC on the quality of water for human consumption.⁴
- Any compound of nickel (including the metals in metallic form, as far as these are classified as dangerous substances) is categorized as “heavy metal” and leads to the classification of hazardous waste according to the Commission Decision 2000/532/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste.
- Limit values are specified for nickel by Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (2003/33/EC).⁵
- Maximum air emission limit values for the incineration of waste are established in the Directive 2000/76/EEC on the incineration of waste.⁶

For **nickel sulphate**, a risk management option analysis (RMOA) was completed in the course of the Public Activities Coordination Tool (PACT) of the SVHC Roadmap.⁷ As a result, a binding occupational

² E.g. earrings, necklaces, bracelets and chains, anklets, finger rings, wrist-watch cases, watch straps and tighteners, rivet buttons, rivets, zippers and metal marks, when these are used in garments restricting the rate of nickel release from those parts of such articles coming into direct and prolonged contact with the skin stating that a release of 0,5 µg/cm²/week for a period of at least two years of normal use of the article shall not be exceeded.

³ Average emission limit values (mg/Nm³) for the following heavy metals over a sampling period of a minimum of 30 minutes and a maximum of 8 hours for Nickel and its compounds, expressed as nickel (Ni): 0,5

⁴ 20 µg/l Nickel; the value applies to a sample of water intended for human consumption obtained by an adequate sampling method at the tap and taken so as to be representative of a weekly average value ingested by consumers. Where appropriate the sampling and monitoring methods must be applied in a harmonized fashion to be drawn up in accordance with Article 7(4). Member States must take account of the occurrence of peak levels that may cause adverse effects on human health.

⁵ Leaching limit values for waste acceptable at landfills for inert waste and limit values for non-hazardous waste.

⁶ For nickel and its compounds:

- All average values over the sample period of a minimum of 30 minutes and a maximum of 8 hours: total 0,5 mg/m³ and total 1 mg/m³ for Nickel and its compounds, expressed as nickel (Ni);
- Emission limit values for discharges of waste water from the cleaning of exhaust gase: 0,5 mg/l for Nickel and its compounds, expressed as nickel (Ni)

⁷ https://echa.europa.eu/de/pact/-/substance-rev/1971/term?viewsubstances_WAR_echarevsubstanceportlet_SEARCH_CRITERIA_EC_NUMBER=232-104-9&viewsubstances_WAR_echarevsubstanceportlet DISS=true, last viewed 19.04.2018

exposure limit value (BOELV) was proposed by the French authorities at 0.01 µg/m³ for nickel compounds that is so far not included in Directive 2004/37/EC.⁸ A number of Member States have already set occupational exposure limit (OELs) for nickel and nickel compounds.⁹

For a RMO analysis on environment performed by Denmark, additional data for the sediment compartment were collected in 2012, on the basis of which chronic effects and hazard for freshwater organisms were identified. Based on this data, the RMOA concluded that no risk management measure is appropriate under REACH, but expresses the need for community-wide measures.¹⁰

2. Uses and quantities

Nickel sulphate

Nickel sulphate is a nickel salt with a relatively high production and usage volume, 10,000 to 100,000 tonnes per annum,¹¹ whereas nickel sulfamate is only used in amounts of 100 to 1,000 tonnes per annum, which is the range of a low production volume chemical.¹²

In the course of the analysis of the most appropriate risk management option for nickel sulphate, the main aggregated input given by the Nickel Institute was based on confidentiality issues of individual companies. In the Draft RMO analysis it is concluded that, *“from the documents provided by the Nickel Institute and based on Eurostat data (mass flows), it is estimated that 33,775 tonnes per year of NiSO₄ are manufactured in EU from which 2,390 tonnes are used to manufacture other nickel compounds and 17,900 are consumed by downstream uses (in total 20,290 tonnes are used). However no exportation or other explanation is provided for the remaining non used volume of 13,485 tonnes.”*

In the Draft RMO analysis (2014), the following data are summarized from the registration dossiers:

- a total volume of 55,149 tonnes NiSO₄ per year is expected to be used within the EU,
- 51,248 tonnes are manufactured in the EU (i.e. 93%) and
- 3,901 tonnes are imported (i.e. 7,1%);
- no export has been reported.

As for the downstream uses of nickel sulphate, the following estimation of the used volumes for five main industrial applications of nickel sulphate are listed in the Draft RMO analysis (2014) according to the Nickel Institute¹³: Used volumes of nickel sulphate by main application

- Production of other nickel salts used for catalysts and catalyst precursors: < 3,000 tpa
- Production of other nickel salts (dinitrate, dichloride and hydroxycarbonate): 2,400 tpa

⁸ France (2016): Risk management option analysis, Conclusion document for nickel sulphate, August 2016; <https://echa.europa.eu/documents/10162/026d40c4-7b36-4b8d-910c-bd036af685bf>, last viewed 19.04.2018

⁹ See an overview in: <https://echa.europa.eu/documents/10162/026d40c4-7b36-4b8d-910c-bd036af685bf>, last viewed 19.04.2018

¹⁰ See in France, Anses (2014): Draft analysis of the most appropriate risk management option for nickel sulphate, April 2014; <https://echa.europa.eu/documents/10162/214f5817-72ce-9514-2862-43a991f1e00d>, last viewed 19.04.2018

¹¹ <https://echa.europa.eu/de/registration-dossier/-/registered-dossier/15304>, last viewed 19.04.2018

¹² <https://echa.europa.eu/de/registration-dossier/-/registered-dossier/14782>, last viewed 19.04.2018

¹³ According to the Nickel Institute, volumes can be easily over or underestimated. There isn't always a hermetic wall between different chemicals and the way they are reported; downstream users often buy a nickel chemical as an intermediate to produce another nickel chemical; this is the case in the catalyst industry and the batteries' sector where some nickel chemicals are produced in-house from another nickel containing chemical.

- Production of nickel metal powder: 2,400 tpa
- Surface treatment: 12,000 tpa
- Total (without batteries): 19,800 tpa
- Batteries manufacturing: Confidential

The use in surface treatment, also called “nickel plating”, is considered by the nickel industry to be an intermediate use resulting in inclusion into or onto a matrix. Nickel plating is used in a range of applications (electrical and electronics, printing applications, automotive, hygiene, currency/security applications, including hologram production, coinage and banknote production and also in decorative applications). In the electrical and electronics industry (including audio recording, CD/DVD production, computer hard drives and in shielding electronic equipment), nickel is precipitated onto aluminum or steel battery housings, connectors, transistor terminals and beds, semi-conductor components and in anti-corrosion base coatings on connectors:

“One of the most important uses of nickel plating in the electronics industry is to create a diffusion barrier to prevent gold, tin and copper from diffusing into each other, leading to failure of chips, connections and circuit boards. Nickel sulphate is particularly used in electroless plating technology for chip assemblies, printed circuit boards and electrical connectors.

The electronics industry has been driven by the need to meet RoHS requirements, particularly the requirement for lead-free solder. According to Industry, it is still not clear that the available lead-free solders can meet the strict reliability and safety requirements of the aerospace and defense industries. The use of nickel diffusion barriers has grown with the advent of lead-free solders because the solders have higher melting points, which greatly increases inter - diffusion between copper and gold during wave soldering.

Nickel plating is also used in electrical connectors for critical applications such as aerospace and defense. Connectors are typically made of aluminum or steel, coated with a thin layer of nickel for corrosion resistance and adhesion, overcoated with cadmium plate for corrosion resistance and galvanic compatibility, and passivated with chromate. Some electrical connector companies are now attempting to eliminate the use of cadmium, and are replacing it with either electroless nickel-PTFE or with zinc-nickel electroplate.”

Nickel sulfamate

As for nickel sulfamate, similar uses were summarized in the study of Oeko-Institut 2014¹⁴ (end use in the manufacture of computer, electronic and optical products and electrical equipment), however, the amounts are much smaller.

¹⁴ Oeko-Institut (2014): Study for the Review of the List of Restricted Substances under RoHS 2. Analysis of Impacts from a Possible Restriction of Several New Substances under RoHS 2 by Gensch, C.-O., Baron, Y. Blepp, M., Bunke, D., Moch, K.; Revised Final Version 06.08.2014;
http://rohs.exemptions.oeko.info/fileadmin/user_upload/RoHS_Substance_Review/20140806_Substance_Review_revised_version_final_plus_Dossier.pdf, last viewed 19.04.2018

Table 2: Overview on uses of nickel sulfamate

	Nickel sulfamate
ECHA: Total Tonnage Band	100 – 1,000 t/y
Uses according to Nickel Consortia	Metal surface treatment (nickel electroforming, nickel electroplating and nickel electroless technologies) Production of batteries Production of nickel salts from nickel sulphate

Source: Nickel Consortia according to Oeko-Institut 2014