

76-2 (2004)	Nickel and nickel inorganic compounds, water-insoluble, (as Ni) (excluding Ni(CO)₄)
CAS N°: 7440-02-0	EINECS N°: 231-111-4
EC-LV (8 h): - Lowest European LV (8 h): 0,05 mg/m³ Highest European LV (8 h): 1 mg/m³	EC-STLV: - Lowest European STLV: 0,1 mg/m³ Highest European STLV: 2 mg/m³

SUMMARY OF THE METHOD

Language: English	Reference: Nickel and inorganic compounds of nickel in air (except nickel carbonyl): MDHS 42/2, Methods for the Determination of Hazardous Substances, HSL (1996).
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Summary: Air is drawn through an MCE or other suitable filter mounted in an inhalable sampler. The sample is subjected to hotplate or microwave digestion with one of a number of different mixtures of inorganic acids or fused with KHSO₄. The resulting sample solution is analysed by FAAS or ETAAS.

SAMPLING

Sampler type	Multi-orifice sampler, IOM sampler or CIS, as described in MDHS 14/2 (now MDHS 14/3)
Sampling substrate	MCE membrane filter or other suitable membrane filter
Recommended flow rate	Flow rate according to manufacturer's specifications
Recommended sampling time:	15 min – 8 h
Recommended volume	-

TRANSPORT AND STORAGE

Description/conditions of transport and storage incl. specific issues	The sample filter is transferred to a filter transport cassette for transport to the laboratory, or it is transported in the sampler used for sampling or its internal filter cassette, after sealing with suitable plastic caps. There is a risk of sample loss from the filter if it is not handled carefully during transportation, especially for higher sample loadings, but once in the laboratory samples are stable indefinitely
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ANALYSIS

Sample preparation	Hotplate dissolution with 1+1 HNO ₃ or with HNO ₃ and HClO ₄ ; Microwave dissolution with HNO ₃ or Fusion with KHSO ₄ after wet ashing with HNO ₃ .
Analytical technique	Analysis by FAAS (oxidising air-acetylene flame) or ETAAS.

METHOD EVALUATION DATA	
Range studied	Not applicable – see limit of quantification.
Sampling bias	Overall uncertainty calculation: < 5 % (according to EN 13890) Expanded uncertainty calculation: included in sampling precision
Analytical bias	FAAS: 2,4 % ETAAS: 2,1 %
Method bias	-
Sampling precision	Overall uncertainty calculation: < 5,3 % (according to EN 13890) Expanded uncertainty calculation: 9,2 % (incorporates bias uncertainty)
Analytical precision	FAAS: < 6 % (2,4 – 960 µg/sample) ETAAS < 8 % (0,05 – 3 µg/sample)
Method precision	-
Limit of quantification	FAAS: 0,8 µg per sample ETAAS: 0,03 µg per sample
Overall uncertainty (EN 482)	FAAS: 23 – 26 % ETAAS: 26 %
Expanded uncertainty (EN 482 revised)	FAAS: 24 – 26 % ETAAS: 26 %
INFORMATION IN RELATION TO THE VALIDATION	
Is the sample dissolution procedure described widely applicable?	yes
Does the sample dissolution method include wall deposits, where applicable?	no
Was a test gas atmosphere used, where applicable?	not applicable
How was the recovery determined?	From the analysis of spiked filters.
Was the sampler capacity or breakthrough volume determined?	not applicable
Was temperature and RH considered, where appropriate?	not applicable

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EVALUATION	
Rating category	A 1
Rationale for rating	<p>Up to date methodology, detailed method description, overall uncertainty and expanded uncertainty requirements met.</p> <p>The overall uncertainty data above have been determined from the analytical bias and precision data given in MDHS 42/2 using the calculation method and sampling bias and precision estimates given in EN 13890. The expanded uncertainty data have been calculated using the method described in the EU mandated report Analytical methods for chemical agents. The data are for samples with an air volume of 480 l, collected using an inhalable sampler and prepared by dissolution with 1+1 HNO₃. The method performs similarly with HNO₃ and HClO₄ sample dissolution; using the microwave dissolution procedure a slightly larger air volume is required for the uncertainty requirements to be met at the LLV; whilst the uncertainty requirements cannot be met at the LLV for sample dissolution by fusion with KHSO₄, even with an increased air volume.</p>
Observations	Some transition metals can interfere with determination of nickel. Interferences from iron and chromium were found to be insignificant.
Similar methods	OSHA ID - 121