Nickel and Nickel Alloy Plating Operations:
Controlling the Risk of Inhaling Mist Containing Nickel

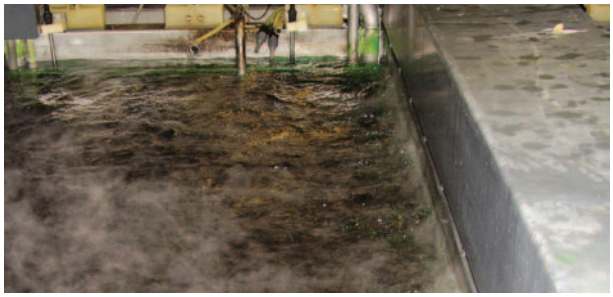
Health Risks

Soluble nickel compounds used in plating operations include nickel sulphate and nickel chloride. Inhaling mist containing such compounds can cause serious health effects such as asthma and there is also evidence to suggest an increased risk of cancer and harm to the unborn child.

Nickel sulphate, carbonate and other nickel substances are likely to be reclassified in 2008 as substances which "may cause cancer by inhalation". The Control of Substances Hazardous to Health (CoSHH) Regulations 2002 require a number of additional precautionary measures to be applied where exposure to a carcinogen cannot be prevented. These measures need not be applied if you can keep these compounds in a non-inhalable form ie a nickel-plating solution does not require additional controls if a mist is not created.

Control

Agitation is required in most nickel-plating operations to ensure a constant supply of nickel at the work surface and to disperse hydrogen and heat. The most commonly used method is air agitation of the plating solution, although alternatives such as mechanical cathode rod movement (usually at 25 revolutions/oscillations per minute) and pumped flow eductors are also used. Air agitation produces a mist containing nickel when the resulting bubbles burst at the plating solution surface. Bubbles of hydrogen and oxygen generated during electrolytic nickel plating also contribute to this mist.



Agitation by pumped flow eductors

Air agitation

The law requires that you address a number of issues in relation to nickel exposure. The first option to consider is substituting nickel for a less hazardous material. In most cases this is likely to be unrealistic but one alternative may be substituting bright zinc for bright nickel plating.

If substitution of a nickel-plating operation is not an option and exposure cannot be prevented, the law requires that exposure is adequately controlled and:

- the process is totally enclosed unless this is not reasonably practicable,
- exposure is less than the workplace exposure limit (WEL) of 0.1 mg/m^3 (as nickel as an eight hour time weighted average), and
- exposure is reduced to as low a level as is reasonably practicable.

Total enclosure is not usually an option but it is clear that a move from air agitation to either cathode rod movement or an eductor system will considerably reduce exposure. Other benefits claimed for eductor systems include heat savings and improved quality for a relatively small capital investment.

Local exhaust ventilation (LEV), usually in the form of lip extraction or push-pull systems, may also be required to ensure adequate control. It is almost always needed where air agitation is used. Issues that should be addressed where LEV is used are:

- ensuring that the minimum freeboard (distance between plating solution surface and the top of the plating tank) is at least 150mm on existing tanks although 300mm or more is preferred,
- the 300mm standard should apply to all new installations but the freeboard on existing tanks can be increased by building up the sides (increasing the freeboard and reducing the LEV flow rate can give substantial savings),
- maintaining the required freeboard using a visual indicator, alarm or automatic dosing,
- checking LEV plant visually at least once a week,
- checking manometers or gauges weekly to ensure that they give acceptable readings (refer to the user's manual),
- supplementing the weekly tests with monthly visual observation of smoke patterns from a smoke generator,
- keeping a log book of checks,
- ensuring that a competent person thoroughly examines and tests LEV plant at least once every 14 months,

- keeping records of examinations and tests for at least five years, and
- taking measures to prevent falls where examination and test requires work at height.

For further information see the HSE publication HSG54 and COSHH essentials guidance sheet G406.

Pressure washing of anode baskets or built-up deposits from the evaporated plating solution etc produces a mist containing nickel salts and should be avoided if possible. If this is not possible, alternative methods should be explored including totally enclosing the pressure washing process or carrying it out in an appropriately designed enclosure fitted with adequate extraction. Respiratory protective equipment (RPE) should only be considered as a last resort and if this is the case, suitable measures must be taken to adequately control other employees' exposure. You must also ensure that you comply with the legal requirements for RPE use. See HSG53 for further information on selecting RPE and the relevant legal requirements.

Monitoring Nickel Exposure

A programme of air sampling and analysis will generally always be necessary where nickel plating is carried out. This programme is usually carried out by a consultant according to one of HSE's methods for the determination of hazardous substances publications (number 42/2). Biological monitoring, based on the analysis of nickel in urine samples, is a useful tool for assessing exposure by inhalation, ingestion and through the skin. HSE has produced guidance on biological monitoring (HSG167) and additional information is available from the Health and Safety Laboratory. A directory listing qualified occupational hygiene consultants who can help with exposure assessment can be obtained from the British Occupational Hygiene Society (BOHS).

When initial monitoring is carried out you should:

- carry out the monitoring under 'worst case' conditions eg maximum throughput and heaviest jig-loading that is normally undertaken,
- take personal air samples to compare with the WEL,
- collect urine samples at the end of shift for analysis of nickel,
- allow employees to see their own monitoring results,
- keep a suitable record of the monitoring and retain it for at least 40 years where personal exposures were determined or for at least 5 years in other cases, and
- carry out any recommendations made by your consultant.

Monitoring should be repeated at regular intervals (your consultant can recommend the frequency) and if there is any change which affects exposure.

For further information see COSHH essentials guidance sheet G409.

Health Surveillance

All employees exposed or liable to be exposed to nickel must be under suitable health surveillance for occupational asthma. An occupational health professional needs to be involved in drawing up your health surveillance programme. If the symptoms of occupational asthma are detected early enough and steps are taken to manage employee exposure, you will minimise the long-term health consequences. Information from suitable health surveillance will also contribute to the assessment of the effectiveness of your controls.

You should appoint a responsible person to complete respiratory questionnaires with employees exposed to nickel. An occupational doctor or nurse should train the responsible person. Questionnaires should be completed pre-employment, after six weeks, after six months and then annually. Examples of initial and follow-up questionnaires are provided in the Appendix. Occupational doctors and nurses can be found via the Society of Occupational Medicine (www.som.org.uk) or in Yellow Pages under "Health and safety consultants" and "Health authorities and services". Other information sources for locating occupational health professionals include NHS Plus (click on the relevant part of the map at www.nhsplus.nhs.uk/local_unit/index.asp) or using an internet search engine with the phrase "occupational health provider".

For further information see COSHH essentials guidance sheet G402.

Information, Instruction and Training

Information, instruction and training are a key part of your health risk management and without it the measures implemented as a result of your risk assessment will not be fully effective. They are best delivered as toolbox talks or "classroom style" as opposed to printed material handed to employees, although the latter can be used to supplement a personal delivery approach.

You should tell employees:

- the typical symptoms of asthma (ie breathlessness, wheezing and tightness of the chest),

- who they should immediately report symptoms to,
- the WEL for nickel,
- the results of their exposure monitoring,
- the collective results of any health surveillance, and
- what plating tanks contain and the hazard associated with the contents by means of appropriate labels.

The information provided must be understandable. For example, you may need to make special provision for those with a limited comprehension of English.

Induction training for new employees should cover:

- the correct use and maintenance of control measures,
- the work practices which prevent or reduce exposure, and
- the emergency procedures.

Information, instruction and training should be reviewed and updated whenever there are significant changes to the work. Consider summarising and documenting the key points, laminating the resulting page or pages and displaying them at appropriate points in the plating shop.

The law requires that pipes and tanks containing nickel salts at concentrations greater than or equal to 0.1% should be marked with the contents and hazard. An appropriate sign for the hazard is shown below.

May cause cancer

Further Information

Maintenance, examination and testing of local exhaust ventilation HSG54 (Second edition) HSE Books 1998 ISBN 0 7176 1485 9

New and existing engineering control systems COSHH guidance sheet G406 HSE 2006 Web only version available at www.hse.gov.uk/pubns/guidance/g406.pdf

Respiratory protective equipment at work HSG53 HSE Books 2005 ISBN 0 7176 2904 X

Biological monitoring in the workplace. A guide to its practical application to chemical exposure HSG167 HSE Books 1997 ISBN 0 7176 1279 1

Contact the Health and Safety Laboratory on 01298 218099 or at www.hsl.gov.uk

Exposure measurement: Air sampling COSHH essentials guidance sheet G409 HSE 2006 Web only version available at www.hse.gov.uk/pubns/guidance/g409.pdf

Contact BOHS on 01332 298101 or at www.bohs.org

Health surveillance for occupational asthma COSHH essentials guidance sheet G402 HSE 2006 Web only version available at www.hse.gov.uk/pubns/guidance/g402.pdf

Appendix

Initial questionnaire for surveillance of people potentially exposed to substances that cause occupational asthma

To be completed by the responsible person

Company name _____

Address _____

_____

_____

In this workplace, substances are in use that have been known to cause allergic chest problems. Following the risk assessment under Regulation 6 of the Control of Substances Hazardous to Health (COSHH) Regulations 2002, management have decided to carry out a programme of pre-exposure and periodic health surveillance as required by regulation 11 of the COSHH Regulations.

In some cases further advice may be required from the company occupational health adviser.

I understand that a programme of health surveillance is necessary in this employment and will form part of my management health record.

Signature of employee _____

Date _____

Signature ofresponsible person _____

Date _____

Referred for further investigation? ☐

Would you please answer the following questions:

1 Surname _____ Forenames _____

Date of Birth _____

Home address _____

_____

_____

Tel number _____

	Yes	No
2 Have you any chest problems, such as periods of breathless, wheeze, chest tightness or persistent coughing?	☐	☐
3 Do you believe that your chest has suffered as a result of any previous employment?	☐	☐
4 Do you or have you ever had any of the following? (Do not include isolated colds, sore throats or flu).		
(a) Recurring soreness of or watering eyes.	☐	☐
(b) Recurring blocked or runny nose.	☐	☐
(c) Bouts of coughing.	☐	☐
(d) Chest tightness.	☐	☐
(e) Wheezing.	☐	☐
(f) Breathlessness.	☐	☐
(g) Any other persistent or history of chest problems.	☐	☐

To be completed by the responsible person.

(a) Further action required.	☐	☐
(b) Refer to company occupational health adviser.	☐	☐

Signature of responsible person _____

Date _____

I confirm that the responses given by me are correct and that I have received a copy of the completed questionnaire.

Signed _____ Date _____

PLEASE NOTE: it will be for a health professional to assess the relevance of any respiratory symptoms and to obtain a detailed smoking history as necessary.

Health questionnaire for on-going surveillance of people potentially exposed to substances that can cause occupational asthma

To be completed by the responsible person

Employee's name _____

Works No. _____

The questionnaire should be completed six weeks and six months after employment commences and annually thereafter on the anniversary of the commencement of employment - unless the company occupational health adviser determines otherwise.

Further advice will be required from the company occupational health adviser if any yes box is ticked.

Since starting your present job have you had any of the following symptoms either at work or at home?
(Do not include isolated colds, sore throats or flu).

	Yes	No
(a) Recurring soreness of or watering eyes.	☐	☐
(b) Recurring blocked or runny nose.	☐	☐
(c) Bouts of coughing.	☐	☐
(d) Chest tightness.	☐	☐
(e) Wheezing.	☐	☐
(f) Breathlessness.	☐	☐
(g) Have you consulted your doctor about chest problems since the last questionnaire?	☐	☐

To be completed by the responsible person.

(a) Further action required.	☐	☐
(b) Refer to company occupational health adviser.	☐	☐

Signature of responsible person _____

Date _____

I confirm that the responses given by me are correct and that I have received a copy of the completed questionnaire.

Signed _____

Date _____

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