Summary

SUMMARY ______________________________________________ 1

A. SOLUTION CALCULATIONS ______________________________ 3
   A.1. Potassium ferricyanide/ferrocyanide .................................. 3
   A.2. Reagents involved ........................................................... 3
   A.3. Nickel solutions ................................................................ 4
       A.3.1. External addition with one sample ................................ 4
       A.3.2. External addition with multiple samples ...................... 6
       A.3.3. Internal addition with Dosinos .................................... 7
       A.3.4. Nickel Wood ............................................................... 7
       A.3.5. Bany Nickel ................................................................. 7

B. RESULTS ______________________________________________ 9
   B.1. Computrace report of nickel determination ......................... 9
   B.2. Nickel Wood determinations .............................................. 15
   B.3. Bany Niquel determinations .............................................. 17

C. SAFETY DATA SHEETS __________________________________ 20
   C.1. Mercury ........................................................................... 20
   C.2. Nickel ............................................................................... 28
   C.3. Dimethylglyoxime .............................................................. 36
   C.4. Nitric acid .......................................................................... 41
A. Solution calculations

In this section the calculations for the preparation of solutions used throughout the project are shown.

A.1. Potassium ferricyanide/ferrocyanide

A mother solution of ferricyanide/ferrocyanide 2 mM with a buffer solution in pH 7.4 of phosphate 100 mM is prepared in 0.5 L. The calculations are the following:

- Ferricyanide:
  \[
  0.5 \text{ L} \cdot \frac{2 \text{ mmol}}{1 \text{ L}} \cdot \frac{1 \text{ mol}}{1000 \text{ mmol}} \cdot \frac{329.24 \text{ g}}{1 \text{ mol}} = 0.3292 \text{ g of } K_3Fe(CN)_6
  \]

- Ferrocyanide:
  \[
  0.5 \text{ L} \cdot \frac{2 \text{ mmol}}{1 \text{ L}} \cdot \frac{1 \text{ mol}}{1000 \text{ mmol}} \cdot \frac{422.39 \text{ g}}{1 \text{ mol}} = 0.4224 \text{ g of } K_4Fe(CN)_6 \cdot 3H_2O
  \]

- Sodium phosphate:
  \[
  0.5 \text{ L} \cdot \frac{0.1 \text{ mol}}{1 \text{ L}} \cdot \frac{177.99 \text{ g}}{1 \text{ mol}} = 8.8995 \text{ g of } Na_2HPO_4 \cdot 2H_2O
  \]

A.2. Reagents involved

- Antimony solution 50 ppm with HCl 0.01 M in 250 mL.
  \[
  250 \text{ mL} \cdot \frac{0.01 \text{ mol}}{1 \text{ L}} \cdot \frac{1 \text{ L}}{1 \text{ mol}} = 2.5 \text{ mL of HCl 1 M}
  \]
  \[
  C_i \cdot V_i = C_f \cdot V_f \rightarrow V_i = \frac{50 \text{ mg} \cdot 250 \text{ mL}}{1000 \text{ mg} \cdot L} = 12.5 \text{ mL of Sb(III) 1000 ppm}
  \]

- Dimethylglyoxime \((C_4H_8N_2O_2)\) 0.1 M in 100 mL and 95% of methanol.
  \[
  100 \text{ mL} \cdot \frac{1 \text{ L}}{1000 \text{ mL}} \cdot \frac{0.1 \text{ mol}}{1 \text{ L}} \cdot \frac{116.11 \text{ g}}{\text{ mol}} = 1.16 \text{ g of } C_4H_8N_2O_2
• Ammonia buffer solution 0.1 M and pH 9.2 in 1 L.

\[ 1 \, L \cdot 0.1 \, \text{mol} \cdot \frac{1 \, L}{13.25 \, \text{mol}} = 7.55 \cdot 10^{-3} \, L = 7.55 \, \text{mL of ammonia solution} \]

A.3. Nickel solutions

Different nickel solutions with different concentrations are prepared from standard solution of Ni (II) 1000 ppm to carry on the determinations. These are used for both external addition or to add into Dosinos.

• Nickel solution 50 ppm (from 1000 ppm) in 50 mL.

\[ C_i \cdot V_i = C_f \cdot V_f \rightarrow 1000 \, \frac{mg}{L} \cdot V_i = 50 \, \frac{mg}{L} \cdot 50 \, mL \]

\[ V_i = 2.5 \, mL \text{ of Ni 1000 ppm sample} \]

• Nickel 20 ppb in cell determination.

\[ 50 \, \frac{mg}{L} \cdot V_i = 0.02 \, \frac{mg}{L} \cdot (20.01 + V_i) \, mL \rightarrow V_i = 8 \cdot 10^{-3} \, mL = 8 \, \muL \text{ of Ni 50 ppm sample} \]

A.3.1. External addition with one sample

First, the concentration of nickel solution that will be added to the cell is calculated.

• Nickel solution 0.8 ppm (from 1000 ppm) in 50 mL.

\[ C_i \cdot V_i = C_f \cdot V_f \rightarrow 1000 \, \frac{mg}{L} \cdot V_i = 0.8 \, \frac{mg}{L} \cdot 50 \, mL \]

\[ V_i = 0.04 \, mL = 40 \, \muL \text{ of Ni 1000 ppm sample} \]

Then, the volume that will be pipetted into each addition is also calculated.

• Addition 1: Nickel 2 ppb in cell.

\[ 0.8 \, \frac{mg}{L} \cdot V_i = 0.002 \, \frac{mg}{L} \cdot (20.01 + V_i) \, mL \rightarrow V_i = 0.05 \, mL = 50 \, \muL \text{ of Ni 0.8 ppm} \]
• Addition 2: Nickel 20 ppb in cell.

\[
0.8 \frac{mg}{L} \cdot (V_i + 0.05) mL = 0.02 \frac{mg}{L} \cdot (20,06 + V_i) mL \rightarrow V_i = 0.463 mL
\]

\[
= 463 \mu L \ of \ Ni \ 0.8 \ ppm
\]

• Addition 3: Nickel 40 ppb in cell.

\[
0.8 \frac{mg}{L} \cdot (V_i + 0.513) mL = 0.04 \frac{mg}{L} \cdot (20,523 + V_i) mL \rightarrow V_i = 0.540 mL
\]

\[
= 540 \mu L \ of \ Ni \ 0.8 \ ppm
\]

• Addition 4: Nickel 60 ppb in cell.

\[
0.8 \frac{mg}{L} \cdot (V_i + 1,053) mL = 0.06 \frac{mg}{L} \cdot (21,063 + V_i) mL \rightarrow V_i = 0.569 mL
\]

\[
= 570 \mu L \ of \ Ni \ 0.8 \ ppm
\]

• Addition 5: Nickel 80 ppb in cell.

\[
0.8 \frac{mg}{L} \cdot (V_i + 1,622) mL = 0.08 \frac{mg}{L} \cdot (21,632 + V_i) mL \rightarrow V_i = 0.601 mL
\]

\[
= 601 \mu L \ of \ Ni \ 0.8 \ ppm
\]

• Addition 6: Nickel 100 ppb in cell.

\[
0.8 \frac{mg}{L} \cdot (V_i + 2,223) mL = 0.1 \frac{mg}{L} \cdot (22,233 + V_i) mL \rightarrow V_i = 0.635 mL
\]

\[
= 635 \mu L \ of \ Ni \ 0.8 \ ppm
\]

• Addition 7: Nickel 120 ppb in cell.

\[
0.8 \frac{mg}{L} \cdot (V_i + 2,859) mL = 0.12 \frac{mg}{L} \cdot (22,869 + V_i) mL \rightarrow V_i = 0.672 mL
\]

\[
= 672 \mu L \ of \ Ni \ 0.8 \ ppm
\]
• Addition 8: Nickel 140 ppb in cell

\[ 0.8 \, \frac{mg}{L} \cdot (V_i + 3.53) \, mL = 0.14 \, \frac{mg}{L} \cdot (23.54 + V_i) \, mL \rightarrow V_i = 0.715 \, mL \]

\[ = 715 \, \mu L \, of \, Ni \, 0.8 \, ppm \]

• Addition 9: Nickel 160 ppb in cell

\[ 0.8 \, \frac{mg}{L} \cdot (V_i + 4.24) \, mL = 0.16 \, \frac{mg}{L} \cdot (24.25 + V_i) \, mL \rightarrow V_i = 0.763 \, mL \]

\[ = 763 \, \mu L \, of \, Ni \, 0.8 \, ppm \]

• Addition 10: Nickel 180 ppb in cell

\[ 0.8 \, \frac{mg}{L} \cdot (V_i + 5) \, mL = 0.18 \, \frac{mg}{L} \cdot (25.01 + V_i) \, mL \rightarrow V_i = 0.809 \, mL \]

\[ = 809 \, \mu L \, of \, Ni \, 0.8 \, ppm \]

**A.3.2. External addition with multiple samples**

All the solutions are prepared from nickel 50 ppm solution

• Nickel solution 0.25 ppm in 50 mL.

\[ V_i = \frac{0.25 \, \frac{mg}{L} \cdot 50 \, mL}{50 \, \frac{mg}{L}} = 0.25 \, mL \, of \, Ni \, 50 \, ppm \]

• Nickel solution 0.5 ppm.

\[ V_i = 0.5 \, mL \, of \, Ni \, 50 \, ppm \]

• Nickel solution 1 ppm.

\[ V_i = 1 \, mL \, of \, Ni \, 50 \, ppm \]

• Nickel solution 2 ppm.

\[ V_i = 2 \, mL \, of \, Ni \, 50 \, ppm \]
- Nickel solution 3 ppm.
  \[ V_i = 3 \, mL \, of \, Ni \, 50 \, ppm \]
- Nickel solution 4 ppm.
  \[ V_i = 4 \, mL \, of \, Ni \, 50 \, ppm \]
- Nickel solution 5 ppm.
  \[ V_i = 5 \, mL \, of \, Ni \, 50 \, ppm \]

The volume added from these samples is constant. So, 1 mL of these prepared solutions will be pipetted in cell each determination.

### A.3.3. Internal addition with Dosinos

- Nickel solution 0.5 ppm in Dosino:
  \[
  50 \, \frac{mg}{L} \cdot V_i = 0.5 \, \frac{mg}{L} \cdot 100 \, mL \Rightarrow V_i = 1 \, mL \, of \, Ni \, 50 \, ppm
  \]

Then, 0.7 mL of this solution is pipetted automatically for the next two determinations to complete the standard addition method.

### A.3.4. Nickel Wood

\[
54604,04 \, \frac{mg}{L} \cdot 1 \, mL = C_f \cdot 100 \, mL \Rightarrow C_{f1NW} = 546,04 \, ppm \, of \, Ni
\]

\[
546,04 \, \frac{mg}{L} \cdot 1 \, mL = C_f \cdot 100 \, mL \Rightarrow C_{f2NW} = 5,46 \, ppm \, of \, Ni
\]

Then, 50 µL of this \( C_{f2} \) were pipetted to cell.

### A.3.5. Bany Nickel

\[
6180,32 \, \frac{mg}{L} \cdot 1 \, mL = C_f \cdot 100 \, mL \Rightarrow C_{f1BN} = 61,80 \, ppm \, of \, Ni
\]

\[
61,80 \, \frac{mg}{L} \cdot 1 \, mL = C_f \cdot 100 \, mL \Rightarrow C_{f2BN} = 0,61 \, ppm = 618 \, ppb \, of \, Ni
\]

In this case, 340 µL of this \( C_{f2} \) were pipetted for determining.
B. Results

B.1. Computrace report of nickel determination

This example shows a default report of Bany nickel determination where different working conditions are observed. The graphics and the calculations are carried out automatically by the software.
Niquel determination

\[
\begin{align*}
I(A) & = \text{function of } U(V) \\
Ni & = 21.966 \text{ mg/L} \\
+/- & = 0.729 \text{ mg/L (3.32%)}
\end{align*}
\]
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes
Peak evaluation

Regression technique: Linear Regression
Peak evaluation: Area
Minimum peak width (V steps): 5
Minimum peak height (A): 1.000e-010
Reverse peaks: No
Smooth factor: 4
Eliminate spikes: Yes

Substances

Ni: -1.050 V +/- 0.050 V
Standard solution: 2 500,000 µg/L
Addition volume (mL): 0.700

default: Final result (Ni) = Conc * (22.36 / 20.36) * (1e+006 / 1) + 0 - 0

Baseline

<table>
<thead>
<tr>
<th>Substance Addition</th>
<th>automatic start (V)</th>
<th>end (V)</th>
<th>type</th>
<th>scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ni</td>
<td>Sample no</td>
<td>-0.927</td>
<td>-1.141 polynomial</td>
<td>wholePeak</td>
</tr>
<tr>
<td>Addition 1 no</td>
<td>-0.927</td>
<td>-1.147</td>
<td>polynomial wholePeak</td>
<td></td>
</tr>
<tr>
<td>Addition 2 no</td>
<td>-0.928</td>
<td>-1.152</td>
<td>polynomial wholePeak</td>
<td></td>
</tr>
</tbody>
</table>

Solutions

<table>
<thead>
<tr>
<th>No.</th>
<th>Content</th>
<th>Predose (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ni</td>
<td></td>
</tr>
</tbody>
</table>

Export options

Export final results as ASCII: no
Export final results as CSV: no
Export final results as XML: no
Export determination to AutoDB: no
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

<table>
<thead>
<tr>
<th>Method parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method</strong></td>
</tr>
<tr>
<td><strong>Title</strong></td>
</tr>
<tr>
<td><strong>Remark</strong></td>
</tr>
</tbody>
</table>

**Calibration:** Standard addition  
**Technique:** Batch  
**Addition:** Automatic  

| Sample ID | Ni  
| Sample amount (mL) | 20.060  
| Cell volume (mL)   | 22.380  

**Voltammetric parameters**

<table>
<thead>
<tr>
<th>Mode</th>
<th>DP - Differential Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest current range</td>
<td>10 mA</td>
</tr>
<tr>
<td>Lowest current range</td>
<td>100 nA</td>
</tr>
<tr>
<td>Electrode</td>
<td>HMDE</td>
</tr>
<tr>
<td>Drop size (l..9)</td>
<td>4</td>
</tr>
<tr>
<td>Stirrer speed (rpm)</td>
<td>2000</td>
</tr>
<tr>
<td>Initial electr. conditioning</td>
<td>No</td>
</tr>
<tr>
<td>No. of additions</td>
<td>2</td>
</tr>
<tr>
<td>No. of replications</td>
<td>2</td>
</tr>
<tr>
<td>Measure blank</td>
<td>No</td>
</tr>
<tr>
<td>Addition purge time (s)</td>
<td>60</td>
</tr>
<tr>
<td>Initial purge time (s)</td>
<td>300</td>
</tr>
<tr>
<td>Conditioning cycles</td>
<td></td>
</tr>
<tr>
<td>Start potential (V)</td>
<td>-1.200</td>
</tr>
<tr>
<td>End potential (V)</td>
<td>-0.100</td>
</tr>
<tr>
<td>No. of cycles</td>
<td>0</td>
</tr>
<tr>
<td>Hydrodynamic (measurement)</td>
<td>No</td>
</tr>
<tr>
<td>Cleaning potential (V)</td>
<td>-1.250</td>
</tr>
<tr>
<td>Cleaning time (s)</td>
<td>30,000</td>
</tr>
<tr>
<td>Deposition potential (V)</td>
<td>-0.700</td>
</tr>
<tr>
<td>Deposition time (s)</td>
<td>120,000</td>
</tr>
</tbody>
</table>

| Sweep                  |                          |
| Equilibration time (s) | 20,000                   |
| Start potential (V)    | -0.850                   |
| End potential (V)      | -1.200                   |
| Voltage step (V)       | 0.000                    |
| Voltage step time (s)  | 0.400                    |
| Sweep rate (V/s)       | 0.014                    |
| Pulse amplitude (V)    | 0.050                    |
| Pulse time (s)         | 0.040                    |

Cell off after measurement: Yes  
Peak evaluation

5/6
Regression technique: Linear Regression
Peak evaluation: Height
Minimum peak width (V.steps): 5
Minimum peak height (A): 1.000e-010
Reverse peaks: No
Smooth factor: 4
Eliminate spikes: Yes

Substances:

N1: -1.050 V +/- 0.050 V
Standard solution: 2 500 000 mg/L
Addition volume (mL): 0.700

default: Final result (N1) = Conc * ((22.35 / 20.95) * (1e+006 / 1) + 0 - 0

Baseline:

<table>
<thead>
<tr>
<th>Substance Addition</th>
<th>automatic start (V) and (V) type</th>
<th>scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1 Sample</td>
<td>yes</td>
<td>***</td>
</tr>
<tr>
<td>Addition 1</td>
<td>yes</td>
<td>***</td>
</tr>
<tr>
<td>Addition 2</td>
<td>yes</td>
<td>***</td>
</tr>
</tbody>
</table>

Solutions:

<table>
<thead>
<tr>
<th>No.</th>
<th>Content</th>
<th>Preload (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N1</td>
<td></td>
</tr>
</tbody>
</table>

Export options:
Export final results as ASCII: no
Export final results as CSV: no
Export final results as XML: no
Export determination to AutoDB: no
B.2. Nickel Wood determinations

These determinations of Nickel Wood were obtained from the standard addition during the project.

- With the SPE Nº53.

![Graph](image1)

**Fig. B.1.** Determination of Nickel Wood by standard addition. (SPE Nº53)

![Graph](image2)

**Fig. B.2.** Standard addition of Nickel Wood (SPE Nº53). Points of OriginLab baseline.

\[
\text{Area: } C_{NW} = 20.86 \text{ ppb}  \quad \text{Peak Height: } C_{NW} = 23.84 \text{ ppb}
\]
- With the SPE Nº54.

Fig. B.3. Determination of Nickel Wood by standard addition. (SPE Nº54).

Area: $C_{NW} = 21.7\text{ ppb}$  
Peak Height: $C_{NW} = 22.68\text{ ppb}$

- With the SPE Nº55.

Fig. B.5. Determination of Nickel Wood by standard addition. (SPE Nº55).
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

B.3. Bany Nickel determinations

These determinations of Bany Nickel were obtained from the standard addition during the project.

- With the SPE Nº56

![Graph showing standard addition](image1)

**Fig. B.6.** Standard addition of Niquel Wood (SPE Nº55). Points of OriginLab baseline.

\[
Area: C_{NW} = 30.5 \text{ ppb} \quad \text{Peak Height: } C_{NW} = 27.11 \text{ ppb}
\]

![Graph showing standard addition](image2)

**Fig. B.7.** Determination of Bany Nickel by standard addition. (SPE Nº56).
Fig. B.8. Standard addition of Bany Nickel (SPE Nº56). Points of OriginLab baseline.

\[ \text{Area: } C_{BN} = 26.45 \text{ ppb} \quad \text{Peak Height: } C_{BN} = 29.24 \text{ ppb} \]

With the SPE Nº57

Fig. B.9. Determination of Bany Nickel by standard addition. (SPE Nº57).

Fig. B.10. Standard addition of Bany Nickel (SPE Nº57). Points of OriginLab baseline.

\[ \text{Area: } C_{BN} = 26.6 \text{ ppb} \quad \text{Peak Height: } C_{BN} = 24.01 \text{ ppb} \]
With the SPE Nº 58.

**Fig. B.11.** Determination of Bany Nickel by standard addition. (SPE Nº58)

**Fig. B.12.** Standard addition of Bany Nickel (SPE Nº58). Points of OriginLab baseline.

\[ \text{Area: } C_{BN} = 18 \text{ ppb} \quad \text{Peak Height: } C_{BN} = 17.9 \text{ ppb} \]
C. Safety Data Sheets

C.1. Mercury

MERCUROY
Safety Data Sheet
according to the latest final rule of hazard communication revised on 2012 (HazCom 2012)
Date of issue: 11/08/2013

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identity

Trade name:
CAS No:
Other names of identification:

Cubical Mercury, Quick Silver, Liquid Silver, HgO, C50599, Hydrgynum

1.2. Relevant identified uses of the substance/mixture and uses advised against

Use of the substance/mixture:

Variety of industrial, analytical and research applications.

1.3. Details of the supplier of the safety data sheet

Buchhainham Apparatus Company
806 Front Stree
Hellkown, PA 18055
Phone: 610-936-9054

2.4. Emergency telephone number

Emergency number:

1-800-424-6506

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification
Acute Tox. 1 (Inhalation/Ingestion) H330
Repr.1A H360
STOT RE 1 H332
Acute Acute 1 H400
Acute Chronic 1 H410

2.2. Label elements

GHS-US labelling
Hazard pictograms (GHS-US):

Signal word (GHS-US)
Hazard statements (GHS-US):

Danger
H300 - May damage fertility or the unborn child
H372 - Causes damage to organs through prolonged or repeated exposure
H400 - Very toxic to aquatic life
H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (GHS-US):

P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P200 - Do not breathe vapors, gases
P244 - Wash skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P271 - Use only outdoors or in a well-ventilated area
P273 - Avert release to the environment
P280 - Wear protective clothing, protective gloves, eye protection, face protection
P284/313 - In case of inadequate ventilation wear respiratory protection
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P305 + P351 + P338 - IF exposed or complained: Get medical advice/attention
P308 + P315 - IF exposed or complained: Get medical advice/attention
P314 - Get medical advice if you feel unwell
P330 - Specific treatment is urgent (see First Aid measures on this label)
P360 - Collect spillage
P403 + P220 - Store in a well-ventilated place. Keep container tightly closed
P487 - Store locked up
P501 - Dispose of contents/container to comply with applicable local, national and international regulations

2.3. Other hazards

Other hazards which do not result in classification:

When inhaled, Mercury will be rapidly distributed throughout the body. During this time, Mercury will cross the blood-brain barrier, and become oxidized to the Hg (II)  oxidation state. The oxidized species of Mercury cannot cross the blood-brain barrier and thus accumulates in...
Annexes

4.3. Indication of any immediate medical attention and special treatment needed
Treatment for Mercury over-exposure must be given. The following treatment protocol for ingestion of Mercury is from Clinical Toxicology of Commercial Products (6th Edition, 1984).

SECTION 6: Firefighting measures
5.1. Extinguishing media
Suitable extinguishing media: Foam, Dry powder, Carbon dioxide, Water spray, Sand.
Unsuitable extinguishing media: Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture
Fire hazard: Not flammable. Mercury vapors and oxides generated during fires involving this product are toxic.
Readability: Stable. Reacts with some metals. Mercury can react with metals to form amalgams.

5.3. Advice for firefighters
Firefighting instructions: Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment. Do not allow runoff from fire fighting to enter drains or water courses.

Protective equipment for firefighters: Do not enter fire area without proper protective equipment, including respiratory protection.

Other information: Decontaminate all equipment thoroughly after the conclusion of fire-fighting activities.

SECTION 7: Accidental release measures
6.1. Personal precautions, protective equipment and emergency procedures
General measures: Uncontrolled release should be responded to by trained personnel using pre-planned procedures. Evacuate area. Evacuate personnel to a safe area.

6.1.1. For non-emergency personnel
Emergency procedures: Evacuate unnecessary personnel.

6.1.2. For emergency responders
Protective equipment: Equip cleanup crew with proper protection. In the event of a release under 1 pound, the minimum level of "C" Personal Protective Equipment is needed. Triple gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard-hat, and N-1 Purifying Respirator with cartridge appropriate for Mercury.
In the event of a release over 1 pound or when concentration of oxygen in atmosphere is less than 19.6% or unknown, the level "D" Personal Protective Equipment which includes Self-Contained Breathing Apparatus must be worn.

Emergency procedures: Ventilate area.

6.2. Environmental precautions
Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters. Avoid release to the environment.

6.3. Methods and material for containment and cleaning up
For containment: For larger spills, dike area and pump into waste containers. Put into a labelled container and provide safe disposal.

Methods for cleaning up: There are a variety of methods which can be used to clean-up Mercury spills. Use a commercially available Mercury Spill Kit for small spills. A suction pump with aspirator can also be used during clean-up operations. For larger release, a Mercury vacuum can be used. Calcium polysulfide or excess sulfur can also be used for cleanup. Mercury can migrate into cracks and other difficult-to-clean areas; calcium polysulfide and sulfur can be sprinkled alternately into these areas. Decontaminate the area thoroughly. The area should be inspected visually and with colorimetric tubes for Mercury to ensure all traces have been removed prior to re-occupation by non-emergency personnel. Decontaminate all equipment used in response thoroughly. If such equipment cannot be adequately decontaminated, it must be discarded with other spill residues.

Place all spill residues in an appropriate container, seal immediately, and lab appropriately. Dispose of in accordance with federal, state, and local hazardous waste disposal requirements. (Refer to Section 10 of this SDS).

6.4. Reference to other sections
See Section 8: Exposure controls and personal protection.

SECTION 7: Handling and storage
7.1. Precautions for safe handling
Additional hazards when processed: Supervisors and responsible personnel must be aware of personality changes, weight loss, or other sign of Mercury over-exposure in employees using this product. These symptoms can develop gradually and are indicative of potentially severe health effects related to Mercury contamination.
MERCURY
Safety Data Sheet
according to the federal final rule of hazard communication revised on 2012 (HazCom 2012)

Precautions for safe handling:
As with all chemicals, avoid getting Mercury ON YOU or IN YOU. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. Report all Mercury releases promptly. Open container slowly on a stable surface. Drums, tanks and bottles of this product must be properly labeled. Empty containers may contain residual amounts of Mercury and should be handled with care.

Hygiene measures:
Do not eat, drink or smoke when using this product. Always wash hands and face immediately after handling this product, and once again before leaving the workplace. Remove contaminated clothing immediately.

7.3 Conditions for safe storage, including any incompatibilities
Technical measures:
Follow practice indicated in Section 6. Make certain that application equipment is locked and tagged-out safely. Always use this product in an area where adequate ventilation is provided. Decontaminate equipment thoroughly before maintenance begins.

Incompatible materials:
Acetylene and acetylene derivatives, amines, ammonia, 3-bromocynoprene, boron dibromide, boron trifluoride, ethyl ether, isopropyl ether, n-butanol, n-heptane, nitromethane, peracetic acid, peroxides, sodium, silver, tin, and zinc.

Prohibited on mixed storage:
Mercury can attack copper alloys. Mercury can react with many metals (e.g. calcium, lithium, potassium, sodium, rubidium, aluminum) to form amalgams.

Storage area:
Storage area should be made of fire-resistant materials.

Special rules on packaging:
Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged.

7.3 Specific end uses
No additional information available

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Mercury (7439-97-6)

<table>
<thead>
<tr>
<th>Source</th>
<th>Limit Value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA ACGIH</td>
<td>TWA</td>
</tr>
<tr>
<td>USA OSHA</td>
<td>STE (CEILING)</td>
</tr>
</tbody>
</table>

8.2 Exposure controls

Appropriate engineering controls:
Ensure adequate ventilation. Ensure exposure is below occupational exposure limits (where available). Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Personal protective equipment:
Avoid all unnecessary exposure. Gloves, protective clothing, safety glasses. Mis-formation: aerosol mask.

Hand protection:
Wear nitrile gloves for routine industrial use. Use triple gloves for spill response, as stated in Section 6 of this SDS.

Eye protection:
Splash goggles or safety glasses. For operation involving the use of more than 1 pound of Mercury, or if the operation may generate a spray of Mercury, the use of a face shield is recommended.

Skin and body protection:
Wear suitable protective clothing.

Respiratory protection:
Maintain airborne contaminants concentration below provided exposure limits. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134 or applicable state regulations. Use supplied air respiration protection if oxygen levels are below 10.5% or are unknown.

Other information:
Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

8.1 Information on basic physical and chemical properties

Physical state:
Liquid

Colour:
Silver white.
## MERCURY

### Safety Data Sheet

According to the Federal tale of hazard communication revised on 2012 (HazCom 2012)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>Odorless.</td>
</tr>
<tr>
<td>Odor threshold</td>
<td>Not applicable</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Relative evaporation rate (butylacetate=1)</td>
<td>No data available</td>
</tr>
<tr>
<td>Melting point</td>
<td>No data available</td>
</tr>
<tr>
<td>Freezing point</td>
<td>38.87 °C (-37.97 °F)</td>
</tr>
<tr>
<td>Boiling point</td>
<td>No data available</td>
</tr>
<tr>
<td>Flash point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Self-ignition temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Decomposition temperature</td>
<td>No data available</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapour pressure</td>
<td>0.002 mm Hg at 25°C</td>
</tr>
<tr>
<td>Relative vapor density at 20 °C</td>
<td>0.9 (Air = 1)</td>
</tr>
<tr>
<td>Relative density</td>
<td>No data available</td>
</tr>
<tr>
<td>Relative density of saturated gas mixture</td>
<td>13.6</td>
</tr>
<tr>
<td>Solubility</td>
<td>No data available</td>
</tr>
<tr>
<td>Log Pow</td>
<td>No data available</td>
</tr>
<tr>
<td>Log Kow</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity, kinematic</td>
<td>No data available</td>
</tr>
<tr>
<td>Viscosity, dynamic</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive properties</td>
<td>No data available</td>
</tr>
<tr>
<td>Oxidising properties</td>
<td>No data available</td>
</tr>
<tr>
<td>Explosive limits</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

### 9.3. Other information

No additional information available.

### SECTION 10: Stability and reactivity

#### 10.1. Reactivity

Stable. Reacts with some metals. Mercury can react with metals to form amalgams.

#### 10.2. Chemical stability

Not established.

#### 10.3. Possibility of hazardous reactions

Not established. Hazardous polymerization will not occur.

#### 10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

#### 10.5. Incompatible materials

Acetylene and acetylene derivatives, amines, ammonia, 3-bromopropyne, boron diiodophosphate, methyl acide, sodium carbide, heated sulfuric acid, methylsulfate/oxgen mixtures, nitric acid/alcohol mixtures, tertiaryaminotritetramethyloxgen mixtures, alkylsulfer perbromiate mixtures, halogens and strong oxidizers. Mercury can attack copper alloys. Mercury can react with many metals (i.e. calcium, lithium, potassium, sodium, rubidium, aluminum) to form amalgams.

### 10.6. Hazardous decomposition products

If this product is exposed to extremely high temperature in the presence of oxygen or air, toxic vapor of mercury and mercury oxides will be generated.

### SECTION 11: Toxicological information

#### 11.1. Information on toxicological effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity</td>
<td>Fatal if inhaled.</td>
</tr>
<tr>
<td>Skin corrosion/frictionation</td>
<td>Not classified</td>
</tr>
<tr>
<td>p/b: Not applicable</td>
<td></td>
</tr>
<tr>
<td>Serious eye damage/frictionation</td>
<td>Not classified</td>
</tr>
<tr>
<td>Respiratory or skin sensitisation</td>
<td>Not classified</td>
</tr>
<tr>
<td>Germ cell mutagenicity</td>
<td>Not classified</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Based on available data, the classification criteria are not met</td>
</tr>
<tr>
<td></td>
<td>Not classified</td>
</tr>
</tbody>
</table>

ETSEIB
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

**SECTION 12: Ecological information**

**Toxicity**

Ecology - water: Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.

**Mercury (7439-97-6)**

<table>
<thead>
<tr>
<th>LC50 (fish)</th>
<th>Exposure time</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC50 fishes 1</td>
<td>96 h</td>
<td>Cyprinus carpio</td>
</tr>
<tr>
<td>LC50 Daphnia 1</td>
<td>96 h</td>
<td>water flea</td>
</tr>
</tbody>
</table>

**Persistence and degradability**

**Mercury (7439-97-6)**

Persistence and degradability: May cause long-term adverse effects in the environment.

**Bioaccumulative potential**

**Mercury (7439-97-6)**

Bioaccumulative potential: Not established.

**Mobility in soil**

No additional information available

**Other adverse effects**

Other information: Avoid release to the environment.
SECTION 13: Disposal considerations

13.1 Waste treatment methods

Waste disposal recommendations: Dispose in a safe manner in accordance with local/national regulations. Waste disposed must be in accordance with appropriate federal, state, and local regulations. This product, if unaltered by use, should be recycled. If altered by use, recycling may be possible. Consult Bethlehem Apparatus Company for information. Mercury must be disposed of as hazardous waste; it must be handled at a permitted facility or as advised by your local hazardous waste regulatory authority.

Ecology - waste materials: Hazardous waste due to toxicity. Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

14.1. UN number

UN No.(DOT): 2809
DOT NA no.: UN2800

14.2. UN proper shipping name

DOT Proper Shipping Name: Mercury
Department of Transportation (DOT) Hazard Classes: 8 - Class 8 - Corrosive material 49 CFR 173.136

Hazard labels (DOT): 8 - Corrosive substances
6.1 - Toxic substances

DOT Symbols: A - Material is regulated as a hazardous material only when transported by air; W - Material is regulated as a hazardous material only when transported by water

Packing group (DOT): III - Minor Danger

DOT Packaging Exceptions (40 CFR 173.xxxx): 164
DOT Packaging Non Bulk (49 CFR 173.xxxx): 164
DOT Packaging Bulk (49 CFR 173.xxxx): 240

14.3. Additional information

Other information: No supplementary information available.

Overland transport

No additional information available.

Transport by sea

DOT Vessel Stowage Location: B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length, and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (m)(2)(i) of this section is exceeded.

DOT Vessel Stowage Other: 40 - Stow "clear of living quarters", 57 - Stow "away from" azides

Air transport

DOT Quantity Limitations Passenger aircraft (49 CFR 173.27): 35 kg
DOT Quantity Limitations Cargo aircraft only (49 CFR 173.75): 35 kg

SECTION 15: Regulatory information

15.1. US Federal regulations

Mercury (TSCA 7442-07-6)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on SARA Section 313 (Specific toxic chemical listings)

EPA TSCA Regulatory Flag: S - S. - Indicates a substance that is identified in a proposed or final Significant New Uses Rule.

SARA Section 313 - Emission Reporting: 1.0 %

15.2. International regulations

CANADA

192582013 EN (English) 79
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

**MERCURY Safety Data Sheet**

<table>
<thead>
<tr>
<th>Mercury (7439-97-6)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed on the Canadian DSL (Domestic Substances List) Inventory.</td>
<td></td>
</tr>
</tbody>
</table>
| WHMIS Classification | Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects  
Class D Division 2 Subdivision A - Very toxic material causing other toxic effects  
Class E - Corrosive Material |

**EU-Regulations**

<table>
<thead>
<tr>
<th>Mercury (7439-97-6)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed on the EEC Inventory EINECS (European Inventory of Existing Commercial Chemical Substances) substances.</td>
<td></td>
</tr>
</tbody>
</table>

**Classification according to Regulation (EC) No. 1272/2008 [CLP]**

**Classification according to Directive 67/548/EEC or 1999/45/EC**

Not classified

**15.2.2. National regulations**

<table>
<thead>
<tr>
<th>Mercury (7439-97-6)</th>
<th></th>
</tr>
</thead>
</table>
| Listed on the AICS (the Australian Inventory of Chemical Substances)  
Listed on Inventory of Existing Chemical Substances (IECSC)  
Listed on the Korean CECL (Existing Chemical List) Inventory.  
Listed on New Zealand - Inventory of Chemicals (NzIoC)  
Listed on Inventory of Chemicals and Chemical Substances (PICCS)  
Ferocious and Deteriorative Substances Control Law  
Pollutant Release and Transfer Register Law (PRTR Law)  
Listed on the Canadian Ingredient Disclosure List |  |

**15.3. US State regulations**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION 18: Other information**

| Other information | None. |

Full list of H-phrases: see section 16:

| Acute Tox. 1 (inhalation/dermat/mist) | Acute toxicity (inhalation/dermat/mist) Category 1 |
| Acute Tox. 2 (inhalation) | Acute toxicity (inhalation) Category 2 |
| Aquatic Acute 1 | Hazardous to the aquatic environment — Acute Hazard, Category 1 |
| Aquatic Chronic 1 | Hazardous to the aquatic environment — Chronic Hazard, Category 1 |
| Repr. 1B | Reproductive toxicity Category 1B |
| STOT RE1 | Specific target organ toxicity (repeated exposure) Category 1 |
| H300 | Fatal if inhaled |
| H360 | May damage fertility or the unborn child |
| H372 | Causes damage to organs through prolonged or repeated exposure |
| H410 | Very toxic to aquatic life |
| H411 | Very toxic to aquatic life with long lasting effects |

**NFPA health hazard** 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

**NFPA fire hazard** 0 - Materials that will not burn.

**NFPA reactivity** 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.
## 1. Identification

**Product Name**
Nickel, reference standard solution 1000 ppm

**Cat No.**
SN70-100; SN70-500

**Synonyms**
None.

**Recommended Use**
Laboratory chemicals.

**Uses advised against**
No information available

**Details of the supplier of the safety data sheet**
- **Company**: Fisher Scientific
  - **Address**: One Reagent Lane
  - **City**: Fair Lawn, NJ 07410
  - **Tel**: (201) 796-7100
- **Emergency Telephone Number**
  - CHEMTREC®, Inside the USA: 800-424-9300
  - CHEMTREC®, Outside the USA: 001-703-527-3837

## 2. Hazard(s) Identification

**Classification**
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

<table>
<thead>
<tr>
<th>Hazard Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosive to metals</td>
<td>Category 1</td>
</tr>
<tr>
<td>Skin Corrosion/Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Serious Eye Damage/Eye Irritation</td>
<td>Category 2</td>
</tr>
<tr>
<td>Respiratory Sensitization</td>
<td>Category 1</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 1A</td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>Category 1B</td>
</tr>
<tr>
<td>Specific target organ toxicity (single exposure)</td>
<td>Category 3</td>
</tr>
<tr>
<td>Target Organs - Respiratory system</td>
<td></td>
</tr>
</tbody>
</table>

**Label Elements**
- **Signal Word**: Danger
- **Hazard Statements**
  - May be corrosive to metals
  - Causes skin irritation
  - Causes serious eye irritation
  - May cause respiratory irritation
  - May cause cancer by inhalation
  - May damage the unborn child

---

**Page 1 / 9**
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

Precautionary Statements

Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Avoid breathing dust/inhalation or vapors/spray
In case of inadequate ventilation wear respiratory protection
Use only outdoors or in a well-ventilated area
Keep only in original container

Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Spills
Absorb spillage to prevent material damage
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Store in corrosive resistant polypropylene container with a resistant inner liner
Store in a dry place
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazard not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING! This product contains a chemical known in the State of California to cause cancer.

3. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>97.5</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>7697-31-2</td>
<td>2.0</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate (1:2:6)</td>
<td>13478-30-7</td>
<td>0.5</td>
</tr>
</tbody>
</table>

4. First-aid Measures

General Advice
If symptoms persist, call a physician.

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.
Nickel, reference standard solution 1000 ppm

Revision Date 05-Jan-2016

Skin Contact
Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation
Move to fresh air. Get medical attention if symptoms occur. If not breathing, give artificial respiration.

Ingestion
Clean mouth with water and drink afterwards plenty of water.

Most important symptoms/effects
None reasonably foreseeable.

Notes to Physician
Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media
No information available

Flash Point
Not applicable

Autoignition Temperature
No information available

Explosion Limits
No information available

Lower
No data available

Sensitivity to Mechanical Impact
No data available

Sensitivity to Static Discharge
No information available

Specific Hazards Arising from the Chemical
Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Nitrogen oxides (NOx), Nitrous vapors, Nickel oxides.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

<table>
<thead>
<tr>
<th></th>
<th>Health</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

6. Accidental release measures

Personal Precautions
Use personal protective equipment. Ensure adequate ventilation.

Environmental Precautions
Should not be released into the environment. Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system.

Methods for Containment and Clean Up
Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling
Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.

Storage
Conceives area. Do not store in metal containers. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Appearance</td>
<td>Blue green</td>
</tr>
<tr>
<td>Odor</td>
<td>Odorless</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>&lt; 2.0</td>
</tr>
<tr>
<td>Melting Point/Range</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Boiling Point/Range</td>
<td>&gt; 100 °C / 212 °F</td>
</tr>
<tr>
<td>Flash Point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>&gt; 1 (ether = 1)</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability or explosive limits</td>
<td>No data available</td>
</tr>
<tr>
<td>Upper</td>
<td>No data available</td>
</tr>
<tr>
<td>Lower</td>
<td>No data available</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>14 mmHg @ 20 °C</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>0.7</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>&gt; 1.0</td>
</tr>
<tr>
<td>Solubility</td>
<td>Soluble in water</td>
</tr>
<tr>
<td>Partition coefficient: n-octanol/water</td>
<td>No data available</td>
</tr>
<tr>
<td>Autoignition Temperature</td>
<td>No information available</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>No information available</td>
</tr>
</tbody>
</table>
Nickel, reference standard solution 1000 ppm

Viscosity
No information available

10. Stability and reactivity

Reactive Hazard
None known, based on information available

Stability
Stable under normal conditions.

Conditions to Avoid
Excess heat. Incompatible products.

Incompatible Materials
Strong bases, Strong reducing agents

Hazardous Decomposition Products
Nitrogen oxides (NOx), Nitrous vapors, Nickel oxides

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
No acute toxicity information is available for this product.

Oral LD₅₀
Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD₅₀
Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC₅₀
Category 3. ATE = 2 - 10 mg/l.

Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD₅₀ Oral</th>
<th>LD₅₀ Dermal</th>
<th>LC₅₀ Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>Not listed</td>
<td>Not listed</td>
<td>LC₅₀ = 2500 ppm</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate (1:2:6)</td>
<td>LD₅₀ = 120 mg/kg (Rat)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Severe eye irritant. Irritating to respiratory system and skin

Sensitization
No information available

Carcinogenicity
Contains a known or suspected carcinogen. The table below indicates whether each agency has listed any ingredient as a carcinogen.

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS.No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>7732-18-6</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>7667-37-2</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate (1:2:6)</td>
<td>13478-00-7</td>
<td>Group 1</td>
<td>Known</td>
<td>Not listed</td>
<td>X</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Possibly Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)
KPN 1 - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Mutagenic Effects
No information available

Reproductive Effects
Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects
No information available.
Nickel, reference standard solution 1000 ppm

Teratogenicity
No information available.

STOT - single exposure
Respiratory system

STOT - repeated exposure
None known

Aspiration hazard
No information available

Symptoms / effects, both acute and delayed
No information available

Endocrine Disruptor Information
No information available

Other Adverse Effects
The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment. May cause long-term adverse effects in the environment. Do not allow material to contaminate ground water system.

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Flea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>Not listed</td>
<td>LC50 = 72 mg/L, 96h (Gambusia affinis)</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Persistence and Degradability
May persist

Bioaccumulation / Accumulation
No information available.

Mobility

<table>
<thead>
<tr>
<th>Component</th>
<th>log Pow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>-2.3</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
UN-No: UN3264
Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Proper technical name: Nitric acid
Hazard Class: 8
Packing Group: III

TDG
UN-No: UN3264
Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Hazard Class: 8
Packing Group: III

IATA
UN-No: UN3264
Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Hazard Class: 8
Packing Group: III

IMDG/MPO
UN-No: UN3264
Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Hazard Class: 8
Packing Group: III
# 15. Regulatory Information

All of the components in the product are on the following inventory lists: \( \times = \text{listed}

## International Inventories

<table>
<thead>
<tr>
<th>Component</th>
<th>TSCA</th>
<th>DSL</th>
<th>NDSL</th>
<th>EINECS</th>
<th>ELINCS</th>
<th>NLP</th>
<th>PICCS</th>
<th>ENCS</th>
<th>AICS</th>
<th>IECSC</th>
<th>KECL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>231-701-1</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>231-714-2</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Legend:
- X = Listed
- E = Indicates a substance that is the subject of a Section 6(a) Consent Order under TSCA.
- F = Indicates a substance that is the subject of a Section 6(f) Rule under TSCA.
- N = Indicates a polymERIC substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
- P = Indicates a commodity PMN substance
- R = Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
- S = Indicates a substance that is identified in a proposed or final Significant New Use Rule
- T = Indicates a substance that is the subject of a Section 4 test rule under TSCA.
- XU = Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Use Reports (40 CFR 710(b)).
- Y1 = Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
- Y2 = Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

## U.S. Federal Regulations

### TSCA 12(b)

Not applicable

#### SARA 313

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>7697-37-2</td>
<td>2.0</td>
<td>1.0 (1.0)</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate</td>
<td>13476-00-7</td>
<td>0.5</td>
<td>0.1 (1.0)</td>
</tr>
</tbody>
</table>

#### SARA 311/312 Hazard Categories

- Acute Health Hazard: Yes
- Chronic Health Hazard: Yes
- Fire Hazard: No
- Sudden Release of Pressure Hazard: No
- Reactive Hazard: No

### CWA (Clean Water Act)

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>X</td>
<td>1000 lb</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>

### Clean Air Act

<table>
<thead>
<tr>
<th>Component</th>
<th>HAPS Data</th>
<th>Class 1 Ozone Depletors</th>
<th>Class 2 Ozone Depletors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel(II) nitrate, hexahydrate</td>
<td>X</td>
<td>Class 2</td>
<td></td>
</tr>
</tbody>
</table>

### OSHA Occupational Safety and Health Administration

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifically Regulated Chemicals</th>
<th>Highly Hazardous Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>-</td>
<td>TQ: 500 lb</td>
</tr>
</tbody>
</table>

Page 7/9
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

---

Nickel, reference standard solution 1000 ppm

Revision Date: 05-Jan-2016

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances ROs</th>
<th>CERCLA EHS ROs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>1000 lb</td>
<td>1000 lb</td>
</tr>
</tbody>
</table>

California Proposition 65

This product contains the following proposition 65 chemicals:

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>California Prop. 65</th>
<th>Prop 65 NSRL</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel(II) nitrate, hexahydrate (1:2:6)</td>
<td>13478-00-7</td>
<td>Cardiogen</td>
<td>-</td>
<td>Cardiogen</td>
</tr>
</tbody>
</table>

U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nitric acid</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nickel(II) nitrate, hexahydrate (1:2:6)</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant: N
DOT Severe Marine Pollutant: N

U.S. Department of Homeland Security

This product contains the following DHS chemicals:

<table>
<thead>
<tr>
<th>Component</th>
<th>DHS Chemical Facility Anti-Terrorism Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>2000 lb STQ</td>
</tr>
</tbody>
</table>

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

E Corrosive material
D1B Toxic materials
D2A Very toxic materials

---

16. Other information

Prepared By: Regulatory Affairs
Thermo Fisher Scientific
Email: EM/SOS.RA@thermo.com

Creation Date: 26-Sep-2009
Revision Date: 05-Jan-2016
Print Date: 05-Jan-2016
Revision Summary: This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Page 8 / 9
C.3. Dimethylglyoxime

Material Safety Data Sheet
Dimethylglyoxime MSDS

<table>
<thead>
<tr>
<th>Section 1: Chemical Product and Company Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Name:</strong> Dimethylglyoxime</td>
</tr>
<tr>
<td><strong>Catalog Codes:</strong> SLD1848</td>
</tr>
<tr>
<td><strong>CAS#:</strong> 95-45-4</td>
</tr>
<tr>
<td><strong>RTECS:</strong> EK2975000</td>
</tr>
<tr>
<td><strong>TSCA:</strong> TSCA 8(b) inventory: Dimethylglyoxime</td>
</tr>
<tr>
<td><strong>C#</strong>: Not available</td>
</tr>
<tr>
<td><strong>Synonym:</strong> 2,3-Butanedionediol; Bisacetyl dioloxide; Diacetyl-dioxime; 2,3-Dioxan-2,5-dimethanol</td>
</tr>
<tr>
<td><strong>Chemical Name:</strong> 2,3-Butanediol Dioxide</td>
</tr>
<tr>
<td><strong>Chemical Formula:</strong> C4H8N2O2</td>
</tr>
<tr>
<td><strong>Contact Information:</strong></td>
</tr>
<tr>
<td>ScienceLab.com, Inc.</td>
</tr>
<tr>
<td>14025 Smith Rd.</td>
</tr>
<tr>
<td>Houston, Texas 77396</td>
</tr>
<tr>
<td><strong>US Sales:</strong> 1-800-901-7247</td>
</tr>
<tr>
<td><strong>International Sales:</strong> 1-281-441-4400</td>
</tr>
<tr>
<td><strong>Order Online:</strong> ScienceLab.com</td>
</tr>
<tr>
<td><strong>CHEMTREC (24HR Emergency Telephone), call:</strong></td>
</tr>
<tr>
<td>1-800-424-9300</td>
</tr>
<tr>
<td><strong>International CHEMTREC, call:</strong> 1-703-627-3887</td>
</tr>
<tr>
<td><strong>For non-emergency assistance, call:</strong> 1-281-441-4400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 2: Composition and Information on Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Composition:</strong></td>
</tr>
<tr>
<td><strong>Name</strong> Dimethylglyoxime</td>
</tr>
<tr>
<td><strong>CAS #</strong> 95-45-4</td>
</tr>
<tr>
<td><strong>% by Weight</strong> 100</td>
</tr>
</tbody>
</table>

**Toxicological Data on ingredients:** Dimethylglyoxime LD50: Not available. LC50: Not available.

<table>
<thead>
<tr>
<th>Section 3: Hazards Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potential Acute Health Effects:</strong></td>
</tr>
<tr>
<td>Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation.</td>
</tr>
<tr>
<td><strong>Potential Chronic Health Effects:</strong></td>
</tr>
<tr>
<td>CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 4: First Aid Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eye Contact:</strong></td>
</tr>
<tr>
<td>Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.</td>
</tr>
</tbody>
</table>
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** These products are carbon oxides (CO, CO2), nitrogen oxides (NO, NO2...).

**Fire Hazards in Presence of Various Substances:** Slightly flammable to flammable in presence of heat.

**Explosion Hazards in Presence of Various Substances:**
Slightly explosive in presence of open flames and sparks. Non-explosive in presence of shocks.

**Fire Fighting Media and Instructions:**
SMALL FIRE. Use DRY chemical powder. LARGE FIRE. Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:**
As with most organic solids, fire is possible at elevated temperatures

**Special Remarks on Explosion Hazards:**
Fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard.

Section 6: Accidental Release Measures

**Small Spill:**
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

**Large Spill:**
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, reducing agents, acids.

**Storage:**
Keep container tightly closed. Keep container in a cool, well-ventilated area.
### Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:** Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:** Not available.

### Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid. (Crystalline solid.)

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 116.12 g/mole

**Color:** White. Off-white.

**pH (1% soln/water):** Not applicable.

**Boiling Point:** Not available.

**Melting Point:** 239°C (462.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Not available.

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatile:** 0% (v/v).

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, methanol, diethyl ether, acetone.

**Solubility:** Soluble in methanol, diethyl ether, acetone. Insoluble in cold water.

### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat

**Incompatibility with various substances:** Reactive with oxidizing agents, reducing agents, acids.
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

Corrosivity: Non-corrosive in presence of glass.
Special Remarks on Reactivity: Not available.
Special Remarks on Corrosivity: Not available.
Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation, Ingestion.
Toxicity to Animals:
LD50: Not available. LC50: Not available.
Chronic Effects on Humans: Not available.
Other Toxic Effects on Humans:
Hazardous in case of ingestion. Slightly hazardous in case of skin contact (irritant), of inhalation.
Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose. LDL [Rat] - Route: Oral; Dose: 250 mg/kg
Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic)
Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. Eyes: May cause eye irritation. Inhalation: May cause respiratory tract and mucous membranes irritation. Ingestion: May be harmful if swallowed. May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated.

Section 12: Ecological Information

Ecotoxicity: Not available.
BOD₅ and COD: Not available.
Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.
Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.
Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).
Identification: Not applicable.
Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information
Federal and State Regulations: TSCA 8(b) inventory: Dimethylglyoxime

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCCL (EEC):
R22: Harmful if swallowed. S24/25: Avoid contact with skin and eyes. S36: Wear suitable protective clothing.

HMIS (U.S.A.):
  Health Hazard: 1
  Fire Hazard: 1
  Reactivity: 0
  Personal Protection: E

National Fire Protection Association (U.S.A.):
  Health: 1
  Flammability: 1
  Reactivity: 0
  Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

---

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 11:50 AM

Last Updated: 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, however arising, even if ScienceLab.com has been advised of the possibility of such damages.
C.4. Nitric acid

SAFETY DATA SHEET

Creation Date 12-Mar-2009  Revision Date 15-Dec-2015  Revision Number 4

1. Identification

Product Name Nitric acid (65 - 70%)
Synonyms Azotic acid; Engraver's acid; Aqua fortis
Recommended Use Laboratory chemicals.

2. Hazard(s) Identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

- Oxidizing liquids Category 2
- Corrosive to metals Category 1
- Skin Corrosion/Irritation Category 1A
- Serious Eye Damage/Eye Irritation Category 1
- Specific target organ toxicity (single exposure) Category 3
- Target Organ - Respiratory system.

Label Elements

Signal Word Danger

Hazard Statements
May cause fire or explosion; strong oxidizer
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation
3. Composition / information on ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>7697-31-2</td>
<td>65 - 70</td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>30 - 35</td>
</tr>
</tbody>
</table>

4. First-aid measures

General Advice
Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Eye Contact
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

5. Fire-fighting measures

Suitable Extinguishing Media
CO₂, dry chemical, dry sand, alcohol-resistant foam.

Unsuitable Extinguishing Media
No information available

Flash Point
Not applicable

Method -
No information available

Autoignition Temperature
No information available

Explosion Limits

Upper
No data available

Lower
No data available

Oxidizing Properties
Oxidizer

Sensitivity to Mechanical Impact
No information available

Sensitivity to Static Discharge
No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. The product causes burns of eyes, skin and mucous membranes. Oxidizer. Contact with combustible/organic material may cause fire. May ignite combustibles (wood paper, oil, clothing, etc.).

Hazardous Combustion Products
Nitrogen oxides (NOₓ) Thermal decomposition can lead to release of irritating gases and vapors

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA
Health 4 Flammability 0 Instability 0 Physical hazards OX

6. Accidental release measures

Personal Precautions
Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions
Should not be released into the environment. Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological information.

Methods for Containment and Clean Up
Seal up with inert absorbent material. Keep in suitable, closed containers for disposal. Sweep up and shovel into suitable containers for disposal.
7. Handling and storage

Handling
Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Do not breathe vapors or spray mist. Keep away from clothing and other combustible materials.

Storage
Keep containers tightly closed in a cool, well-ventilated place. Do not store near combustible materials.

8. Exposure controls / personal protection

<table>
<thead>
<tr>
<th>Component</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
<th>NIOSH IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>TWA: 2 ppm, STEL: 4 ppm</td>
<td>(Vacated) TWA: 2 ppm, STEL: 4 ppm</td>
<td>IDLH: 25 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Vacated) STEL: 4 ppm</td>
<td>TWA: 2 ppm, STEL: 4 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Vacated) STEL: 10 mg/m³</td>
<td>TWA: 2 ppm, STEL: 5 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Quebec</th>
<th>Mexico OEL (TWA)</th>
<th>Ontario TWA/EV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>TWA: 2 ppm, STEL: 6.2 mg/m³</td>
<td>TWA: 2 ppm, STEL: 5 mg/m³</td>
<td>TWA: 2 ppm, STEL: 10 mg/m³</td>
</tr>
</tbody>
</table>

Legend
ACGIH: American Conference of Governmental Industrial Hygienists
OSHA: Occupational Safety and Health Administration
NIOSH/IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures
Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment
Eye/Face Protection
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA’s eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tightly fitting safety goggles. Face-shield.

Skin and body protection
Long sleeved clothing.

Respiratory Protection
Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures
Keep away from food, drink and animal feeding stuffs. When using, do not eat, drink or smoke. Contaminated work clothing should not be allowed out of the workplace. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes and clothing. For environmental protection remove and wash all contaminated protective equipment before re-use. Wear suitable gloves and eye/face protection.

9. Physical and chemical properties

<table>
<thead>
<tr>
<th>Physical state</th>
<th>Liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Clear Colorless, Light yellow</td>
</tr>
<tr>
<td>Odor</td>
<td>Strong Acid</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>No information available</td>
</tr>
<tr>
<td>pH</td>
<td>&lt; 1.0 (0.1M)</td>
</tr>
</tbody>
</table>
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

Pág. 45

10. Stability and reactivity

Reactive Hazard
Yes

Stability
Oxidizer: Contact with combustible/organic material may cause fire.

Conditions to Avoid
Incompatible products. Combustible material. Excess heat. Exposure to air or moisture over prolonged periods.

Incompatible Materials

Hazardous Decomposition Products
Nitrogen oxides (NOx). Thermal decomposition can lead to release of irritating gases and vapors

Hazardous Polymerization
Hazardous polymerization does not occur.

Hazardous Reactions
None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Oral LD₅₀
Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD₅₀
Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC₅₀
Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

<table>
<thead>
<tr>
<th>Component</th>
<th>LD₅₀ Oral</th>
<th>LD₅₀ Dermal</th>
<th>LC₅₀ Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>Not listed</td>
<td>Not listed</td>
<td>LC₅₀ &gt; 2000 ppm (FID) 1h</td>
</tr>
<tr>
<td>Water</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Toxicologically Synergistic Products
No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation
Causes severe burns by all exposure routes

Sensitization
No information available

Carcinogenicity
The table below indicates whether each agency has listed any ingredient as a carcinogen

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>IARC</th>
<th>NTP</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>Mexico</th>
</tr>
</thead>
</table>

Page 5 / 9
Nitrile acid (65 - 70%)

<table>
<thead>
<tr>
<th>Component</th>
<th>Freshwater Algae</th>
<th>Freshwater Fish</th>
<th>Microtox</th>
<th>Water Fowl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrile acid</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Mutagenic Effects: No information available.
Reproductive Effects: No information available.
Developmental Effects: No information available.
Teratogenicity: No information available.
STOT - single exposure: Respiratory system.
STOT - repeated exposure: None known.
Aspiration hazard: No information available.
Symptoms / effects, both acute and delayed: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated.
Endocrine Disruptor information: No information available.
Other Adverse Effects: The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity: Do not empty into drains. Large amounts will affect pH and harm aquatic organisms. Contains a substance which is harmful to aquatic organisms. The product contains following substances which are hazardous for the environment.

<table>
<thead>
<tr>
<th>Component</th>
<th>Log P ow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrile acid</td>
<td>-2.3</td>
</tr>
</tbody>
</table>

13. Disposal considerations

Waste Disposal Methods: Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
- UN-No: UN2031
- Proper Shipping Name: NITRIC ACID
- Hazard Class: 8
- Subsidiary Hazard Class: 5.1
- Packing Group: II

TDG
- UN-No: UN2031
- Proper Shipping Name: NITRIC ACID
- Hazard Class: 8
- Subsidiary Hazard Class: 5.1
- Packing Group: II

IATA
- UN-No: UN2031
An alternative to the use of mercury electrode on the determination of metal ions in voltammetric techniques: Screen-Printed Electrodes

### Nitric acid (65 - 70%)

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>7697-37-2</td>
<td>65 - 70</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**SARA 313**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS-No</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>7697-37-2</td>
<td>65 - 70</td>
</tr>
</tbody>
</table>

**SARA 311/312 Hazard Categories**

- Acute Health Hazard: Yes
- Chronic Health Hazard: Yes
- Fire Hazard: No
- Sudden Release of Pressure Hazard: No
- Reactive Hazard: Yes

**CWA (Clean Water Act)**

<table>
<thead>
<tr>
<th>Component</th>
<th>CWA - Hazardous Substances</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>X</td>
<td>1000 lb</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Clean Air Act**

Not applicable

**OSHA** Occupational Safety and Health Administration
Nitric acid (65 - 70%)  
Revision Date 15-Dec-2015

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifically Regulated Chemicals</th>
<th>Highly Hazardous Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>-</td>
<td>TG: 500 lb</td>
</tr>
</tbody>
</table>

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Component</th>
<th>Hazardous Substances RQs</th>
<th>CERCLA EHS RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>1000 lb</td>
<td>1000 lb</td>
</tr>
</tbody>
</table>

California Proposition 65
This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know
Regulations

<table>
<thead>
<tr>
<th>Component</th>
<th>Massachusetts</th>
<th>New Jersey</th>
<th>Pennsylvania</th>
<th>Illinois</th>
<th>Rhode Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Water</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

U.S. Department of Transportation
Reportable Quantity (RQ): Y
DOT Marine Pollutant: N
DOT Severe Marine Pollutant: N

U.S. Department of Homeland Security
This product contains the following DHS chemicals:

<table>
<thead>
<tr>
<th>Component</th>
<th>DHS Chemical Facility Anti-Terrorism Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitric acid</td>
<td>2000 lb STQ</td>
</tr>
</tbody>
</table>

Other International Regulations
Mexico - Grafo
No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class
C Oxidizing materials
E Corrosive material
D2B Toxic materials

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 12-Mar-2009
Revision Date 15-Dec-2016
Print Date 15-Dec-2016
Revision Summary
This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the