SECTION 1. IDENTIFICATION

Product Name: Silver Nanoparticle Ink

Product Number: All applicable American Elements product codes, e.g. AG-M-02-NPI, AG-M-025-NPI, AG-M-03-NPI, AG-M-035-NPI, AG-M-04-NPI

CAS #: 7440-22-4

Relevant identified uses of the substance: Scientific research and development

Supplier details:
American Elements
10884 Weyburn Ave.
Los Angeles, CA 90024
Tel: +1 310-208-0551
Fax: +1 310-208-0351

Emergency telephone number:
+1 800-424-9300

SECTION 2. HAZARDS IDENTIFICATION

Classification of the substance or mixture
Hazard Statements: H400-H410
Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
Precautionary Statements: P273-P391-P501a
Avoid release to the environment. Collect spillage. Dispose of contents/container in accordance with local/regional/national/international regulations.

Classification system
HMIS ratings (scale 0-4)
(Hazardous Materials Identification System)
Health (acute effects) = 1
Flammability = 0
Physical Hazard = 1
Other hazards
Results of PBT and vPvB assessment:
PBT:
N/A.
SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances
CAS No. / Substance Name:
7440-22-4 Silver
Identification number(s):
EC number:
231-131-3

SECTION 4. FIRST AID MEASURES

Description of first aid measures
If inhaled:
Supply fresh air. If not breathing, provide artificial respiration. Keep patient warm.
Seek immediate medical advice.
In case of skin contact:
Immediately wash with soap and water; rinse thoroughly.
Seek immediate medical advice.
In case of eye contact:
Rinse opened eye for several minutes under running water. Consult a physician.
If swallowed:
Seek medical treatment.

Information for doctor
Most important symptoms and effects, both acute and delayed
No information available.
Indication of any immediate medical attention and special treatment needed
No information available.

SECTION 5. FIREFIGHTING MEASURES

Extinguishing media
Suitable extinguishing media
Special powder for metal fires. Do not use water.
For safety reasons unsuitable extinguishing media
Water
Special hazards arising from the substance or mixture
If this product is involved in a fire, the following can be released:
Metal oxide fume
Advice for firefighters
Protective equipment:
Wear self-contained respirator.
Wear fully protective impervious suit.
SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation

Environmental precautions:
Do not allow material to be released to the environment without official permits.

Methods and material for containment and cleanup:
Pick up mechanically.

Prevention of secondary hazards:
No special measures required.

Reference to other sections
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

SECTION 7. HANDLING AND STORAGE

Handling
Precautions for safe handling
Keep container tightly sealed.
Store in cool, dry place in tightly closed containers.
Ensure adequate ventilation.

Information about protection against explosions and fires:
No data available.

Conditions for safe storage, including any incompatibilities
Storage
Requirements to be met by storerooms and receptacles:
No special requirements.

Information about storage in one common storage facility:
Do not store together with oxidizing and acidic materials.

Further information about storage conditions:
Keep container tightly sealed.
Store in cool, dry conditions in well-sealed containers.
Specific end use(s)
No information available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Additional information about design of technical systems:
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Control parameters
Components with limit values that require monitoring at the workplace:
7440-22-4 Silver (100.0%)
PEL (USA) Long-term value: 0.01 mg/m³
metal and soluble compounds (as Ag)
REL (USA) Long-term value: 0.01 mg/m³
TLV (USA) Long-term value: 0.1 mg/m³
metal: dust and fume
EL (Canada) Short-term value: 0.03 mg/m³
Long-term value: 0.01 mg/m³
as Ag
EV (Canada) Long-term value: 0.1* 0.01** mg/m³
*metal;**water-soluble compounds (as silver)
Additional information:
No data
Exposure controls
Personal protective equipment
Follow typical general protective and industrial hygiene measures for handling chemicals.
Keep away from foodstuffs, beverages and feed.
Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Breathing equipment:
Use suitable respirator when high concentrations are present.
Protection of hands:
Impervious gloves
Inspect gloves prior to use.
Suitability of gloves should be determined both by material and quality, the latter of which may vary by manufacturer.
Penetration time of glove material (in minutes)
No data available.
Eye protection:
Safety glasses
Body protection:
Protective work clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties
Appearance:
Form: Various forms (powder/flake/crystalline/beads, etc.)
Color: Silver-colored
Odor: Characteristic
Odor threshold: No data available.
pH: N/A.
Melting point/range: 961.8 °C (1763 °F)
Boiling point/range: 2210 °C (4010 °F)
Sublimation temperature / start: No data available.
Flammability (solid, gas):
No data available.
Ignition temperature: No data available.
Decomposition temperature: No data available.
Auto igniting: No data available.
Danger of explosion: No data available.
Explosion limits:
Lower: No data available.
Upper: No data available.
Vapor pressure: N/A.
Density at 20 °C (68 °F): 10.5 g/cm³ (87.623 lbs/gal)
Relative density
No data available.
Vapor density
N/A.
Evaporation rate
Solubility in Water (H$_2$O): Insoluble
Partition coefficient (n-octanol/water): No data available.
Viscosity:
Dynamic: N/A.
Kinematic: N/A.
Other information
No information available.

SECTION 10. STABILITY AND REACTIVITY

Reactivity
No data available.
Chemical stability
Stable under recommended storage conditions.
Thermal decomposition / conditions to be avoided:
Decomposition will not occur if used and stored according to specifications.
Possibility of hazardous reactions
No dangerous reactions known
Conditions to avoid
No information available.
Incompatible materials:
Oxidizing agents
Hazardous decomposition products:
Metal oxide fume

SECTION 11. TOXICOLOGICAL INFORMATION

Information on toxicological effects
Acute toxicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for this substance.
LD/LC50 values that are relevant for classification:
No data
Skin irritation or corrosion:
May cause irritation
Eye irritation or corrosion:
May cause irritation
Sensitization:
No sensitizing effects known.
Germ cell mutagenicity:
N/A
Carcinogenicity:
EPA-D: Not classifiable as to human carcinogenicity: inadequate human and animal evidence of carcinogenicity or no data are available.
The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for this substance.
Reproductive toxicity:
N/A
Specific target organ system toxicity - repeated exposure:
N/A
Specific target organ system toxicity - single exposure:
N/A
Aspiration hazard:
N/A
Subacute to chronic toxicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) contains multiple dose toxicity data for this substance.
Additional toxicological information:
To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.
Carcinogenic categories
OSHA-Ca (Occupational Safety & Health Administration)
Substance is not listed.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity
Aquatic toxicity:
No information available.
Persistence and degradability:
No information available.
Bioaccumulative potential:
No information available.
Mobility in soil:
No information available.
Ecotoxicological effects:
Remark:
Very toxic for aquatic organisms
Additional ecological information:
General notes:
Do not allow product to reach ground water, water course or sewage system.
Do not allow material to be released to the environment without official permits.
Danger to drinking water if even small quantities leak into the ground.
Also poisonous for fish and plankton in water bodies.
May cause long lasting harmful effects to aquatic life.
Avoid transfer into the environment.
Very toxic for aquatic organisms
Results of PBT and vPvB assessment:
PBT:
N/A.
vPvB:
N/A.
Other adverse effects
No information available.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste treatment methods
Recommendation:
Consult state, local or national regulations to ensure proper disposal.
Uncleaned packagings:
Recommendation:
Disposal must be made according to official regulations.

**SECTION 14. TRANSPORT INFORMATION**

UN-Number
DOT, IMDG, IATA
UN3077

UN proper shipping name
DOT
Environmentally hazardous substances, solid, n.o.s. (Silver)
IMDG
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Silver), MARINE POLLUTANT
IATA
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Silver)

Transport hazard class(es)
DOT, IMDG, IATA
Class
9 Miscellaneous dangerous substances and articles.
Label
9
Class
9 (M7) Miscellaneous dangerous substances and articles
Label
9

Packing group
DOT, IMDG, IATA

III
Environmental hazards:
Marine pollutant (IMDG):
Yes (P)
Symbol (fish and tree)
Special marking (ADR):
Symbol (fish and tree)
Special marking (IATA):
Symbol (fish and tree)
Special precautions for user
Warning: Miscellaneous dangerous substances and articles
EMS Number: F-A,S-F

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
N/A.

Transport/Additional information:
DOT
Marine Pollutant (DOT):
No
Remarks:
Special marking with the symbol (fish and tree).
UN "Model Regulation":
UN3077, Environmentally hazardous substances, solid, n.o.s. (Silver), 9, III
SECTION 15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations
All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.
All components of this product are listed on the Canadian Domestic Substances List (DSL).
SARA Section 313 (specific toxic chemical listings)
7440-22-4 Silver
California Proposition 65
Prop 65 - Chemicals known to cause cancer
Substance is not listed.
Prop 65 - Developmental toxicity
Substance is not listed.
Prop 65 - Developmental toxicity, female
Substance is not listed.
Prop 65 - Developmental toxicity, male
Substance is not listed.
Information about limitation of use:
For use only by technically qualified individuals.
Other regulations, limitations and prohibitive regulations
Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006.
Substance is not listed.
The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No 1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed.
Substance is not listed.
Annex XIV of the REACH Regulations (requiring Authorisation for use)
Substance is not listed.
Chemical safety assessment:
A Chemical Safety Assessment has not been carried out.

SECTION 2. HAZARDS IDENTIFICATION

Classification of the substance or mixture in accordance with 29 CFR 1910 (OSHA HCS)
GHS02 Flame
Flam. Liq. 2 H225 Highly flammable liquid and vapor.
GHS07
Eye Irrit. 2
H319 Causes serious eye irritation.
STOT SE 3 H336 May cause drowsiness or dizziness.
Hazards not otherwise classified
No data available
GHS label elements
GHS label elements, including precautionary statements
Hazard pictograms

GHS02 GHS07
Signal word
Danger
Hazard statements
H225 Highly flammable liquid and vapor.
H319 Causes serious eye irritation.
H336 May cause drowsiness or dizziness.
Precautionary statements
P210
Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P261
Avoid breathing dust/fume/gas/mist/vapors/spray.
P303+P361+P353 If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P405
Store locked up.
P501
Dispose of contents/container in accordance with local/regional/national/international regulations.
WHMIS classification
B2 - Flammable liquid
D2B - Toxic material causing other toxic effects
Classification system
HMIS ratings (scale 0-4)
(Hazardous Materials Identification System)
Health (acute effects) = 1
Flammability = 3
Physical Hazard = 1
Other hazards
Results of PBT and vPvB assessment
PBT: N/A
vPvB: N/A

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances
CAS No. / Substance Name:

7440-22-4 Silver
Identification number(s):
EC number: 231-131-3

67-63-0 2-Propanol
Identification number(s):
EC number: 200-661-7
Index number: 603-117-00-0

SECTION 4. FIRST AID MEASURES

Description of first aid measures
If inhaled:
Supply patient with fresh air. If not breathing, provide artificial respiration. Keep patient warm.
Seek immediate medical advice.
In case of skin contact:
Immediately wash with soap and water; rinse thoroughly.
Seek immediate medical advice.
In case of eye contact:
Rinse opened eye for several minutes under running water. Consult a physician.
If swallowed:
Seek medical treatment.
Information for doctor
Most important symptoms and effects, both acute and delayed
No data available
Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5. FIREFIGHTING MEASURES
Extinguishing media
Suitable extinguishing agents
Carbon dioxide, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
Special hazards arising from the substance or mixture
If this product is involved in a fire, the following can be released:
Carbon monoxide and carbon dioxide
Advice for firefighters
Protective equipment:
Wear self-contained respirator.
Wear fully protective impervious suit.

SECTION 6. ACCIDENTAL RELEASE MEASURES
Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Keep unprotected persons away.
Ensure adequate ventilation
Keep away from ignition sources
Environmental precautions:
Do not allow product to enter drains, sewage systems, or other water courses.
Methods and materials for containment and cleanup:
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Ensure adequate ventilation.
Prevention of secondary hazards:
Keep away from ignition sources.
Reference to other sections
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

SECTION 7. HANDLING AND STORAGE
Handling
Precautions for safe handling
Keep container tightly sealed.
Store in cool, dry place in tightly closed containers. 
Ensure good ventilation at the workplace. 
Information about protection against explosions and fires: 
Protect against electrostatic charges. 
Fumes can combine with air to form an explosive mixture. 
Keep ignition sources away. 
Conditions for safe storage, including any incompatibilities 
Requirements to be met by storerooms and receptacles: 
Store in a cool location. 
Information about storage in one common storage facility: 
Do not store together with acids. 
Store away from oxidizing agents. 
Store away from halogens. 
Store away from acid anhydrides. 
Further information about storage conditions: 
Keep container tightly sealed. 
Store in cool, dry conditions in well-sealed containers. 
Specific end use(s) 
No data available

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure controls
Personal protective equipment
Follow typical protective and hygienic practices for handling chemicals. 
Keep away from foodstuffs, beverages and feed. 
Remove all soiled and contaminated clothing immediately. 
Wash hands before breaks and at the end of work. 
Avoid contact with the eyes. 
Avoid contact with the eyes and skin. 
Maintain an ergonomically appropriate working environment. 
Breathing equipment: 
Use suitable respirator when high concentrations are present. 
Recommended filter device for short term use: 
Use a respirator with multi-purpose combination (US) or type ABEK (EN 14387) as a backup to engineering controls. Risk assessment should be performed to determine if air-purifying respirators are appropriate. Only use equipment tested and approved under appropriate government standards such as NIOSH (USA) or CEN (EU). 
Protection of hands: 
Impervious gloves 
Inspect gloves prior to use. 
Suitability of gloves should be determined both by material and quality, the latter of which may vary by manufacturer. 
Material of gloves 
Nitrile rubber, NBR 
Penetration time of glove material (in minutes) 
480 
Glove thickness 
0.4 mm 
Eye protection: 
Safety glasses 
Body protection: 
Protective work clothing.
SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties
Appearance:
Form: Liquid
Odor: Alcohol-like
Odor threshold: No data available.
pH: No data available.
Melting point/Melting range: No data available.
Boiling point/Boiling range: No data available.
Sublimation temperature / start: No data available
Flash point: No data available.
Flammability (solid, gas)
No data available.
Ignition temperature: No data available.
Decomposition temperature: No data available
Autoignition: No data available.
Danger of explosion: Product is not explosive. However, formation of explosive air/vapor mixtures is possible.
Relative density
No data available.
Vapor density
No data available.
Evaporation rate
No data available.
Viscosity:
dynamic at 20 °C (68 °F): No data available.
Kinematic: No data available.
Other information
No data available

SECTION 10. STABILITY AND REACTIVITY

Reactivity
No data available
Chemical stability
Stable under recommended storage conditions.
Thermal decomposition / conditions to be avoided:
Decomposition will not occur if used and stored according to specifications.
Possibility of hazardous reactions
Reacts with strong oxidizing agents
Conditions to avoid
No data available
Incompatible materials:
Acids
Oxidizing agents
Halogens
Acid anhydrides
Hazardous decomposition products:
Carbon monoxide and carbon dioxide
SECTION 11. TOXICOLOGICAL INFORMATION

Information on toxicological effects

Acute toxicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute toxicity data for this substance.
LD/LC50 values that are relevant for classification:
Oral
LD50
5045 mg/kg (rat)
Dermal
LD50
12800 mg/kg (rabbit)
Inhalative LC50/8H 12560 ppm/8H (rat)
Skin irritation or corruption:
May cause irritation
Eye irritation or corrosion:
Causes serious eye irritation.
Sensitization:
No sensitizing effects known.
Germ cell mutagenicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) contains mutation data for this substance.
Carcinogenicity:
IARC-3: Not classifiable as to carcinogenicity to humans.
ACGIH A4: Not classifiable as a human carcinogen: Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals.
Reproductive toxicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive data for this substance.
Specific target organ system toxicity - repeated exposure:
No effects known.
Specific target organ system toxicity - single exposure:
May cause drowsiness or dizziness.
May cause respiratory irritation.
Aspiration hazard:
No effects known.
Subacute to chronic toxicity:
The Registry of Toxic Effects of Chemical Substances (RTECS) contains multiple dose toxicity data for this substance.
Additional toxicological information:
To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

SECTION 12. ECOLOGICAL INFORMATION

Toxicity
Aquatic toxicity:
No data available
Persistence and degradability
No data available
Bioaccumulative potential
Mobility in soil
No data available

Additional ecological information:
Do not allow undiluted product or large quantities to reach groundwater, water courses, or sewage systems.
Avoid transfer into the environment.

Results of PBT and vPvB assessment
PBT:
N/A
vPvB:
N/A

Other adverse effects
No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Waste treatment methods
Recommendation
Consult official regulations to ensure proper disposal.

Uncleaned packagings:
Recommendation:
Disposal must be made according to official regulations.

Recommended cleansing agent:
Water, if necessary with cleansing agents.

SECTION 14. TRANSPORT INFORMATION

UN-Number
DOT, IMDG, IATA
UN1219

UN proper shipping name
DOT
Isopropanol (Isopropyl alcohol)
IMDG, IATA
ISOPROPANOL (ISOPROPYL ALCOHOL)

Transport hazard class(es)
DOT
Class
3 Flammable liquids.
Label
3

Class
3 (F1) Flammable liquids
Label
3

IMDG, IATA
Class
3 Flammable liquids.
Label
3
Packing group
DOT, IMDG, IATA
II
Environmental hazards:
N/A
Special precautions for user
Warning: Flammable liquids
EMS Number: F-E,S-D
Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
N/A
Transport/Additional information:
DOT
Marine Pollutant (DOT):
No
UN "Model Regulation":
UN1219, Isopropanol (Isopropyl alcohol), 3, II

SECTION 15. REGULATORY INFORMATION

National regulations
All components of this product are listed in the U.S. Environmental Protection Agency Toxic
Substances Control Act Chemical substance Inventory.
All components of this product are listed on the Canadian Domestic Substances List (DSL).
SARA Section 313 (specific toxic chemical listings)
67-63-0 2-Propanol
California Proposition 65
Prop 65 - Chemicals known to cause cancer
Substance is not listed.
Prop 65 - Developmental toxicity
Substance is not listed.
Prop 65 - Developmental toxicity, female
Substance is not listed.
Prop 65 - Developmental toxicity, male
Substance is not listed.
Information about limitation of use:
For use only by technically qualified individuals.
Other regulations, limitations and prohibitive regulations
Substance of Very High Concern (SVHC) according to the REACH Regulations (EC) No. 1907/2006.
Substance is not listed.
The conditions of restrictions according to Article 67 and Annex XVII of the Regulation (EC) No
1907/2006 (REACH) for the manufacturing, placing on the market and use must be observed.
Substance is not listed.
Annex XIV of the REACH Regulations (requiring Authorisation for use)
Substance is not listed.
Chemical safety assessment:
A Chemical Safety Assessment has not been carried out.

SECTION 16. OTHER INFORMATION

Safety Data Sheet according to Regulation (EC) No. 1907/2006 (REACH). The above information is
believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The