AHK-Cu

CAS: 682809-81-0
Formula: C15H24ClCuN6O4-

Document ID: 9ae3fedd
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Version: 1.0

Section 1 — Product and Company Identification

Product Name	AHK-Cu
Synonyms	682809-81-0; AHK-Cu; [L-Alanyl-N-L-histidyl-N,N3-L-lysinato(2-)]copper Monohydrochloride
CAS Number	682809-81-0
Molecular Formula	C15H24ClCuN6O4-
IUPAC Name	copper;(2S)-6-amino-2-[[(2S)-2-[(2S)-2-azanidylpropanoyl]azanidyl-3-(1H-imidazol-4-yl)propanoyl]amino]hexanoate;hydrochloride
Identified Uses	Research laboratory chemical for in vitro scientific research and development use only.
Restriction on Use	Not for human or veterinary use. Not for food, drug, cosmetic, household, agricultural, clinical, therapeutic, or diagnostic applications.

Manufacturer / Supplier

Company	Ruo.bio
Address	30 N Gould St, Sheridan, WY 82801, US
Phone	+1-804-636-6879
Website	https://ruo.bio/
Emergency Phone	+1(804)636-6879 - Monday-Friday: 9:00 AM - 5:00 PM Pacific

Section 2 — Hazard Identification

Classification of the substance

Not classified based on currently available data; however, data is limited and hazards cannot be fully characterized. The absence of classification should not be interpreted as a determination of the absence of hazard.

Classification has been conducted in accordance with 29 CFR 1910.1200 (OSHA HazCom 2012) and GHS Rev.8 using all available data and scientifically valid weight-of-evidence approaches (GHS Rev.8 Chapter 1.3.2.4), including read-across from chemical class and structural considerations where substance-specific study data is not available.

Signal Word: None

GHS Pictograms:
None required based on classification.

Hazard Statements
None. This substance is not classified for any GHS hazard class based on available data.

Precautionary Statements

- P261: Avoid breathing dust, fume, gas, mist, vapors, or spray.
- P264: Wash hands and exposed skin thoroughly after handling.
- P280: Wear protective gloves, protective clothing, and eye/face protection.
- P501: Dispose of contents and container in accordance with local, regional, national, and international regulations.

Precautionary statements are provided as best practice for handling substances with limited toxicological data, and are not a declaration of GHS classification.

Hazards Not Otherwise Classified (HNOC)
None known based on available data and weight-of-evidence assessment. The toxicological properties of this substance have not been fully characterized; handle as a potentially bioactive substance of unknown toxicity.

Section 3 — Composition / Information on Ingredients

Single-substance product. Chemical identity:

Ingredient	CAS Number	Mol. Formula	Mol. Weight	Concentration
AHK-Cu	682809-81-0	C15H24ClCuN6O4-	451.39 g/mol	>98% (research grade)

Impurities
No hazardous impurities known to be present above the GHS classification thresholds specified in 29 CFR 1910.1200 Appendix A. Residual synthesis reagents, solvents, and counter-ions may be present at levels consistent with research-grade (>98% purity) material. Balance: non-hazardous impurities. Refer to the accompanying Certificate of Analysis (CoA) for the lot-specific impurity profile.

Section 4 — First Aid Measures

Eye Contact
Rinse cautiously with water for several minutes. If irritation persists, seek medical advice.

Skin Contact
Wash with soap and water. Remove contaminated clothing and wash before reuse. If irritation persists, seek medical advice.

Inhalation
Move affected person to fresh air. If symptoms develop, seek medical advice.

Ingestion
Rinse mouth thoroughly with water. If large amounts are swallowed or if symptoms develop, seek medical advice. Do not induce vomiting unless directed by medical personnel.

Note to Physician
Treat symptomatically. No specific antidote known.

Section 5 — Fire Fighting Measures

Flash Point: *Not determined*

Suitable Extinguishing Media
Use extinguishing media appropriate to the surrounding fire conditions. Carbon dioxide (CO2), dry chemical powder, foam, or water spray.

Special Hazards
May produce toxic gases upon combustion. Carbon monoxide and other combustion products may be generated.

Protective Equipment for Firefighters
Wear self-contained breathing apparatus (SCBA) and full protective gear. Do not enter fire area without proper protective equipment.

Section 6 — Accidental Release Measures

Personal Precautions
Avoid dust formation. Avoid breathing vapors, mist, or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Use personal protective equipment as described in Section 8.

Environmental Precautions
Prevent further leakage or spillage if safe to do so. Do not allow the product to enter drains, sewers, or waterways.

Containment and Cleanup
Sweep up and shovel. Keep in suitable, closed containers for disposal. Avoid raising dust. Clean contaminated surface thoroughly. Dispose of waste in accordance with local regulations (see Section 13).

Section 7 — Handling and Storage

Handling Precautions
Handle in accordance with good industrial hygiene and safety practice consistent with OSHA Hazard Communication Standard (29 CFR 1910.1200) and, where applicable, the OSHA Laboratory Standard (29 CFR 1910.1450). Because comprehensive toxicological data for AHK-Cu (CAS 682809-81-0) are not available, treat as a potentially bioactive substance of unknown toxicity and apply the precautionary principle. Use only in a well-ventilated area, preferably within a chemical fume hood or containment device that provides equivalent protection; avoid generation and inhalation of dusts, aerosols, or mists when weighing or reconstituting the lyophilized solid. Wear chemical-resistant nitrile gloves, a buttoned laboratory coat, and ANSI Z87.1-compliant safety eyewear (chemical splash goggles); if dust exposure cannot be adequately controlled by engineering means, use a NIOSH-approved particulate respirator (e.g., N95 or higher) following a written respiratory protection program per 29 CFR 1910.134. Avoid contact with skin, eyes, and clothing, and avoid ingestion. Do not eat, drink, smoke, or apply cosmetics in areas where the material is handled. Wash hands and exposed skin thoroughly with soap and water after handling and before breaks and at the end of the workday. Keep containers tightly closed when not in use and reseal promptly after each use to minimize exposure to atmospheric moisture, oxygen, and light. Handle small quantities on impervious, easily decontaminated work surfaces, and clean up any residues immediately using wet-wipe techniques to avoid airborne dispersion. Prevent release to the

environment; do not discharge to drains or sewers. Ground and bond containers if transferring in a manner that could generate static, and use non-sparking tools when appropriate.

Storage Conditions

Store the tightly closed original container in a cool, dry, well-ventilated location protected from light. The lyophilized solid should be stored at -20 degC (or colder, as specified on the container label) in a manual-defrost freezer to avoid temperature cycling; allow sealed containers to equilibrate to room temperature before opening to prevent condensation of atmospheric moisture onto the hygroscopic solid. Where feasible, store under an inert atmosphere (dry nitrogen or argon) or with desiccant to limit exposure to humidity and oxygen. Protect from direct sunlight, heat, ignition sources, and incompatible materials (see below). Once reconstituted in aqueous solution, store refrigerated in a tightly capped, chemically compatible container and use within the timeframe validated by the end user; do not rely on solution stability beyond what has been experimentally established. Keep secondary containment in place to contain leaks or spills. Store separately from foodstuffs and away from general laboratory traffic. Restrict access to trained personnel and label all containers, including secondary/working containers, in accordance with 29 CFR 1910.1200(f). Follow all applicable federal, state, and local regulations for storage of hazardous chemicals.

Incompatibilities

Keep away from strong oxidizing agents (e.g., peroxides, permanganates, chlorates, nitric acid, halogens), which can react vigorously with organic ligands and reduced metal centers. Avoid contact with strong acids and strong bases, which may hydrolyze the peptide bonds and disrupt the copper(II)-peptide coordination. Avoid strong reducing agents, which can reduce Cu(II) and alter the complex. As a chloride-containing copper complex, avoid contact with reactive metals (e.g., finely divided aluminum, magnesium, zinc, alkali metals) with which copper salts and chloride can undergo redox or displacement reactions. Protect from moisture, heat, and direct light, which may accelerate decomposition of the peptide-copper complex. Incompatible with cyanides, sulfides, and strong chelating agents (e.g., EDTA), which may liberate or sequester copper from the complex. Store away from foodstuffs, feedstuffs, and incompatible chemical classes as recommended in standard laboratory chemical segregation guidance (e.g., Prudent Practices in the Laboratory, NRC/NAP). No specific reactivity data for AHK-Cu are established in authoritative regulatory sources; the above guidance is based on general incompatibilities of copper(II) complexes, peptides, and chloride salts.

Section 8 — Exposure Controls / Personal Protection

Exposure Limits

No regulatory occupational exposure limit (OEL) has been established specifically for AHK-Cu (CAS 682809-81-0). However, because this substance is a copper-containing complex, the following limits for copper compounds (as Cu) are considered applicable to airborne dusts or mists generated during handling:

* OSHA PEL (29 CFR 1910.1000, Table Z-1): 1 mg/m3 TWA for copper dusts and mists (as Cu). Note: The PEL also applies to other copper compounds (as Cu) except copper fume.
* NIOSH REL: 1 mg/m3 TWA (up to 10-hour) for copper dusts and mists (as Cu). Note: The REL also applies to other copper compounds (as Cu) except copper fume (NIOSH Pocket Guide to Chemical Hazards).
* ACGIH TLV: 1 mg/m3 TWA for copper, dusts and mists (as Cu).
* NIOSH IDLH (revised): 100 mg Cu/m3.

No biological exposure indices (BEIs) have been established for AHK-Cu. No OELs specific to the tripeptide (Ala-His-Lys) moiety have been established by OSHA, ACGIH, NIOSH, or equivalent bodies. Handle as a potentially bioactive substance of unknown toxicity and control exposure to the lowest level reasonably achievable (ALARA) using the engineering controls and PPE specified below.

Engineering Controls

Handle in a well-ventilated area. Use local exhaust ventilation (LEV), a certified chemical fume hood, or a ventilated weighing enclosure/glove box when weighing, transferring, or otherwise generating dusts, mists, or aerosols of the solid or its solutions, to keep airborne concentrations below the applicable copper (as Cu) OEL of 1 mg/m3 (OSHA PEL, NIOSH REL, ACGIH TLV). Provide general dilution ventilation as a supplement, not a substitute, for LEV. Ensure emergency eyewash and safety shower stations are readily accessible in the immediate work area (ANSI/ISEA Z358.1). Segregate the handling area, control access, and use closed transfer/containment systems where practicable. Where dusts may be generated, HEPA-filtered exhaust is recommended. Do not eat, drink, smoke, or apply cosmetics in the work area; wash hands and exposed skin thoroughly after handling.

Personal Protective Equipment

Respiratory Protection: Under normal laboratory handling in a properly functioning fume hood or ventilated enclosure, no respiratory protection is typically required. When engineering controls are insufficient, when weighing the neat solid outside of containment, or when airborne concentrations may approach or exceed the copper (as Cu) OEL of 1 mg/m3, wear a NIOSH-approved (42 CFR Part 84) air-purifying respirator equipped with N100/P100 particulate filters. For higher exposure potential or unknown airborne concentrations, use a powered air-purifying respirator (PAPR) with HEPA filters or a supplied-air respirator. Do not exceed the NIOSH IDLH of 100 mg Cu/m3 with an air-purifying respirator. Respirator use must comply with the OSHA Respiratory Protection Standard (29 CFR 1910.134), including fit testing, medical clearance, and a written program.

Hand Protection: Wear chemical-resistant, impervious gloves meeting EN 374 / ASTM F739. Nitrile rubber gloves (minimum 0.11 mm thickness) are generally recommended for handling small quantities of the solid and aqueous solutions. For prolonged contact, extended handling, or work with concentrated solutions, use butyl rubber or double-glove with nitrile. No specific chemical breakthrough data are published in authoritative sources for AHK-Cu; select gloves based on manufacturer permeation data for copper salts and short peptides, and replace immediately if contamination, degradation, or puncture is suspected. Wash hands thoroughly with soap and water after glove removal and before leaving the work area.

Eye / Face Protection: Wear tight-fitting chemical splash goggles meeting ANSI/ISEA Z87.1 (US) or EN 166 (EU) whenever handling the solid or its solutions. When splash, spray, or aerosol generation is possible (e.g., transferring solutions, sonication, pipetting under pressure), add a full-face shield worn over the goggles. Do not wear contact lenses when handling this material. An emergency eyewash station meeting ANSI/ISEA Z358.1 must be within 10 seconds' travel of the work area.

Skin Protection: Wear a long-sleeved laboratory coat or chemical-resistant lab coat/coverall, closed-toe chemical--resistant footwear, and full-length trousers to prevent skin contact. For work with larger quantities, powders that may generate dust, or when splash potential exists, wear a chemical-resistant apron over the lab coat. Remove and launder contaminated clothing before reuse; do not launder with personal clothing. Do not store or consume food/beverages in the work area. As histidine-containing copper complexes may pose a sensitization risk in previously sensitized individuals, minimize all dermal contact and treat as a potentially bioactive substance of unknown toxicity.

Section 9 — Physical and Chemical Properties

Physical State	Solid (research-grade lyophilised powder or crystalline solid)
Appearance	Blue to purple powder
Odor	Not available.
Odor Threshold	Not available.
Boiling Point	*Not determined*
Melting Point	*Not determined*
Flash Point	*Not determined*
Auto-ignition Temperature	No data available.

Decomposition Temperature	No experimental data available.
Vapor Pressure	*Not determined*
Vapor Density	*Not determined*
Specific Gravity	*Not determined*
Partition Coefficient (log Kow)	No experimental data available.
Solubility	Soluble in water
Stability in Solution	Subject to hydrolytic and oxidative degradation typical of the chemical class; store reconstituted solutions refrigerated or frozen, protect from light, and use within the stability window indicated on the Certificate of Analysis.
pH	*Not determined*
Molecular Weight	451.39 g/mol
Molecular Formula	C15H24ClCuN6O4-

Section 10 — Stability and Reactivity

Chemical Stability: Stable under normal conditions of use, storage, and transport.

Conditions to Avoid: Excessive heat, open flames, sparks, incompatible materials.

Incompatible Materials: Keep away from strong oxidizing agents (e.g., peroxides, permanganates, chlorates, nitric acid, halogens), which can react vigorously with organic ligands and reduced metal centers. Avoid contact with strong acids and strong bases, which may hydrolyze the peptide bonds and disrupt the copper(II)-peptide coordination. Avoid strong reducing agents, which can reduce Cu(II) and alter the complex. As a chloride-containing copper complex, avoid contact with reactive metals (e.g., finely divided aluminum, magnesium, zinc, alkali metals) with which copper salts and chloride can undergo redox or displacement reactions. Protect from moisture, heat, and direct light, which may accelerate decomposition of the peptide-copper complex. Incompatible with cyanides, sulfides, and strong chelating agents (e.g., EDTA), which may liberate or sequester copper from the complex. Store away from foodstuffs, feedstuffs, and incompatible chemical classes as recommended in standard laboratory chemical segregation guidance (e.g., Prudent Practices in the Laboratory, NRC/NAP). No specific reactivity data for AHK-Cu are established in authoritative regulatory sources; the above guidance is based on general incompatibilities of copper(II) complexes, peptides, and chloride salts.

Hazardous Decomposition Products: Upon combustion or decomposition may produce: carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides (NOx), hydrogen chloride (HCl).

Hazardous Polymerization: Will not occur.

Section 11 — Toxicological Information

The toxicological properties of this substance have not been fully characterized. Where no authoritative study data was identified, endpoint classifications are based on a weight-of-evidence approach using read-across from the compound's chemical class and structural features, per GHS Rev.8 Chapter 1.3.2.4. "Not classified" entries below mean "not classified based on currently available data" — hazards cannot be excluded.

Acute Toxicity: Acute toxicity data specific to AHK-Cu (CAS 682809-81-0) have not been established in the peer-reviewed literature or in authoritative regulatory compilations (ECHA, NIOSH, NTP, EPA). No LD50 or LC50 values from authoritative sources are available for this specific copper-tripeptide complex. The substance contains ionic copper, and soluble copper(II) compounds are classified under ECHA/CLP notifications as harmful if swallowed (Acute Tox. Cat. 4, oral). On this weight-of-evidence basis, acute oral hazards cannot be excluded. Not classified based on currently available data; hazards cannot be excluded. Avoid ingestion, inhalation of dust or mist, and skin/eye contact.

Skin Corrosion / Irritation: No skin irritation or corrosion study on AHK-Cu itself has been located in ECHA registration dossiers or peer-reviewed literature. The ionic copper moiety in soluble copper(II) compounds is classified under ECHA/CLP as causing skin irritation (H315, Skin Irrit. Cat. 2), and the hydrochloride counter-ion may contribute to local irritation upon dissolution in moisture on skin. Not classified based on currently available data; hazards cannot be excluded. Handle with impervious gloves and appropriate protective clothing.

Serious Eye Damage / Irritation: No eye irritation study on AHK-Cu has been identified in authoritative sources. Soluble copper(II) salts are classified under ECHA/CLP notifications as causing serious eye irritation (H319, Eye Irrit. Cat. 2), providing weight-of-evidence that the copper-containing salt in AHK-Cu may cause mechanical or chemical irritation of ocular tissue. Not classified based on currently available data; hazards cannot be excluded. Use eye protection meeting ANSI Z87.1 or EN 166.

Skin / Respiratory Sensitization: No respiratory or skin sensitization studies (OECD 429, 442, or human patch data) specific to AHK-Cu have been located in ECHA registration dossiers, NTP, or peer-reviewed literature. Copper ions have been reported in the dermatological literature as occasional contact allergens, though soluble copper compounds are not harmonized-classified as skin sensitizers under CLP Annex VI. The sensitization potential of AHK-Cu is not fully characterized. Not classified based on currently available data; hazards cannot be excluded.

Germ Cell Mutagenicity / Genotoxicity: Not classified based on currently available data; hazards cannot be excluded. Weight-of-evidence assessment applied using read-across from chemical class and structural considerations (GHS Rev.8 Chapter 1.3.2.4); no authoritative substance-specific study data identified.

Carcinogenicity: AHK-Cu (CAS 682809-81-0) is not listed by IARC, NTP (15th Report on Carcinogens), OSHA (29 CFR 1910.1003), ACGIH, or the U.S. EPA IRIS as a known, probable, or possible human carcinogen. Elemental copper and inorganic copper compounds are not classified by IARC (copper 8-hydroxyquinoline is IARC Group 3, per ATSDR Toxicological Profile for Copper, 2022). No long-term carcinogenicity bioassays on AHK-Cu are available. Not classified based on currently available data; hazards cannot be excluded.

Reproductive Toxicity: No reproductive, developmental, or germ-cell mutagenicity studies specific to AHK-Cu have been identified in ECHA registration dossiers, NTP, or peer-reviewed literature. Copper and its inorganic compounds do not carry a harmonized CLP classification for reproductive toxicity under ECHA Annex VI. The reproductive and developmental toxicity of AHK-Cu is not fully characterized. Not classified based on currently available data; hazards cannot be excluded. As a precaution, exposure of pregnant or nursing workers should be minimized.

Specific Target Organ Toxicity (STOT): No specific target organ toxicity (STOT-SE or STOT-RE) studies on AHK-Cu have been located in ECHA registration dossiers or peer-reviewed literature. According to the ATSDR Toxicological Profile for Copper (2022), repeated oral overexposure to soluble copper compounds has been associated with hepatic effects in animals and humans, and inhalation exposure to copper-containing dusts and fumes has been associated with respiratory tract irritation. On this weight-of-evidence basis, the liver and respiratory tract are plausible potential target organs following repeated overexposure to copper-containing substances. AHK-Cu itself is not fully characterized for STOT-SE or STOT-RE endpoints. Not classified based on currently available data; hazards cannot be excluded.

Aspiration Hazard: Not classified based on currently available data; hazards cannot be excluded. Weight-of-evidence assessment applied using read-across from chemical class and structural considerations (GHS Rev.8 Chapter 1.3.2.4); no authoritative substance-specific study data identified.

Derived No-Effect Level (DNEL): No data available — no substance-specific DNEL has been derived.

Predicted No-Effect Concentration (PNEC): No data available — no substance-specific PNEC has been derived.

Section 12 — Ecological Information

No authoritative substance-specific ecotoxicity study data was identified. In the absence of experimental data, adverse environmental effects cannot be fully excluded.

Ecotoxicity: No substance-specific experimental aquatic toxicity data (e.g., fish LC50, Daphnia EC50, algal ErC50) have been identified for AHK-Cu (CAS 682809-81-0) in authoritative databases (ECHA, US EPA ECOTOX, PubChem).

The substance is a copper(II) complex of the tripeptide L-alanyl-L-histidyl-L-lysine (monohydrochloride) and may dissociate under environmental conditions to release Cu(II) ions. Copper ions are recognized by the US EPA (National Recommended Aquatic Life Criteria for Copper) and ECHA as toxic to aquatic organisms, with several inorganic copper substances classified in the EU CLP inventory as Aquatic Acute 1 (H400) and Aquatic Chronic 1 (H410) with M-factors up to 100 (e.g., dicopper oxide, copper dinitrate). On this basis, release of AHK-Cu to the aquatic environment should be avoided as a precaution, pending substance-specific testing. Not formally classified as hazardous to the aquatic environment based on weight-of-evidence assessment (no authoritative experimental data on the intact complex identified).

Persistence and Degradability: No substance-specific experimental biodegradation data (e.g., OECD 301 series ready biodegradability studies) have been identified for AHK-Cu in authoritative sources. The peptide ligand portion (Ala-His-Lys) would be expected to undergo enzymatic hydrolysis in biological/environmental matrices, whereas the copper moiety is an element and is not biodegradable; copper released from the complex will persist and partition/speciate in environmental compartments (US EPA Aquatic Life Criteria - Copper). A definitive persistence assessment for the intact substance cannot be made without experimental data.

Bioaccumulative Potential: No experimentally determined bioconcentration factor (BCF) or log Kow for AHK-Cu has been identified in authoritative databases (ECHA, PubChem, US EPA). As an ionic copper-peptide coordination complex with a hydrochloride counterion and multiple ionizable groups, the substance is expected to be highly water-soluble and to have low log Kow, suggesting limited potential for bioaccumulation of the intact complex in lipid tissues. However, copper(II) released upon dissociation is an essential trace element that is regulated by homeostatic mechanisms in most organisms but can bioaccumulate in certain aquatic invertebrates and algae under elevated exposure conditions (per US EPA copper aquatic life criteria documentation). No substance-specific bioaccumulation conclusion can be drawn.

Mobility in Soil: No substance-specific experimental data identified.

Other Adverse Effects: No other adverse environmental effects identified. The substance is not included on the Montreal Protocol list of ozone-depleting substances.

Section 13 — Disposal Considerations

Dispose of contents and container in accordance with all local, state, and federal regulations. Do not dispose of this material into sewers or waterways. Contact a licensed waste disposal company for disposal guidance.

US: Dispose in accordance with 40 CFR Parts 261-270 (RCRA). **EU:** Dispose according to Directive 2008/98/EC (Waste Framework Directive).

Section 14 — Transport Information

DOT (US)	Not regulated as dangerous goods under DOT (49 CFR) based on current classification.
IATA	Not regulated as dangerous goods under IATA Dangerous Goods Regulations based on current classification.
IMDG	Not regulated as dangerous goods or as a marine pollutant under the IMDG Code based on current classification.
UN Number	Not applicable.

Transport classifications above are based on the substance's intrinsic hazard classification; the shipper must independently verify the classification, packaging, labelling, and documentation requirements for their specific shipment configuration, quantity, and carrier (including airline policies) prior to dispatch.

Section 15 — Regulatory Information

United States

TSCA (Toxic Substances Control Act): May be eligible for exemption from TSCA inventory listing requirements under the R&D provisions of 40 CFR 720.36, depending on actual conditions of use. This substance is supplied solely for use in scientific research and development in small quantities; it is not intended for, and shall not be used for, any commercial manufacturing, processing, or distribution in commerce. The importer/end user is responsible for confirming that the R&D exemption criteria are met for their specific use. **OSHA HazCom 2012:** This SDS was prepared in accordance with 29 CFR 1910.1200 (HazCom 2012), aligned with the Globally Harmonized System (GHS) Rev. 8. **CERCLA / SARA Title III:** Not listed as a CERCLA Hazardous Substance (40 CFR 302.4); not subject to SARA 313 reporting based on available classification data. Users must independently verify applicability for their facility.

European Union

REACH (EC 1907/2006): Supplied solely for Scientific Research and Development (SR&D) use in quantities below 1 tonne per year per legal entity. Where applicable, this use may be exempt from REACH registration obligations under the scientific research and development provisions of REACH Article 3(23) and the conditions of Article 26(3); importers/users should independently verify the applicable exemption pathway for their specific use. If the substance is used as part of a formally notified Product and Process Oriented Research and Development (PPORD) programme, the separate notification procedure under REACH Article 9 (with a 5-year exemption renewable once) may apply instead. **CLP (EC 1272/2008):** Not classified under CLP based on available data; no harmonized classification entry identified in Annex VI of CLP or the ECHA Classification and Labelling (C&L) Inventory.

Canada

WHMIS 2015 / HPR: Not classified as a hazardous product under the Hazardous Products Act and Hazardous Products Regulations (SOR/2015-17) based on available data and weight-of-evidence assessment. Supplied for laboratory research use only. **DSL/NDSL:** Research-use exemption applies; substance is not intended for commercial import or manufacture in Canada.

Note: The regulatory statements above reflect the intended use of this substance for scientific research and development only and do not constitute a legal determination of regulatory status. If the substance is used outside the R&D exemption scope, users are solely responsible for independently verifying applicable regulatory obligations (TSCA, REACH, WHMIS, state, and local) for their specific use and jurisdiction prior to any such use.

Section 16 — Other Information

Document ID	9ae3fedd-c802-4af5-951b-0d7067359c9d
Revision Date	2026-08-13
Version	1.0
Prepared By	Prepared in accordance with GHS Rev.8 and OSHA HazCom 2012 (29 CFR 1910.1200). Independent review by a qualified chemical safety professional is recommended prior to use.

Revision History

Revision date: 2026-08-13
Version: 1.0
Change description: Initial issue. Document prepared in 16-section GHS Rev.8 / OSHA HazCom 2012 format.

Sources Used

- PubChem (U.S. National Library of Medicine / NCBI) — https://pubchem.ncbi.nlm.nih.gov
- Peer-reviewed chemistry and toxicology literature (class-based read-across and weight-of-evidence assessment per GHS Rev.8 Chapter 1.3.2.4)
- OSHA HazCom 2012 / 29 CFR 1910.1200 Appendix A–C; GHS Rev.8; OECD Test Guidelines

Key to Abbreviations

CAS = Chemical Abstracts Service; GHS = Globally Harmonized System of Classification and Labelling of Chemicals; OSHA = U.S. Occupational Safety and Health Administration; HazCom = Hazard Communication Standard; REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals; CLP = Classification, Labelling and Packaging Regulation; TSCA = Toxic Substances Control Act; WHMIS = Workplace Hazardous Materials Information System; OEL = Occupational Exposure Limit; PEL = Permissible Exposure Limit; TLV = Threshold Limit Value; REL = Recommended Exposure Limit; STOT = Specific Target Organ Toxicity; LD50 = Median Lethal Dose; LC50 = Median Lethal Concentration; PPE = Personal Protective Equipment; SCBA = Self-Contained Breathing Apparatus; R&D = Research and Development.

Disclaimer

DISCLAIMER: The information in this Safety Data Sheet is compiled from the authoritative sources cited above, supplemented by weight-of-evidence assessment based on the compound's chemical class and published literature. It is believed to be accurate as of the revision date but is provided "as is" without warranty of any kind, express or implied, including fitness for a particular purpose. The preparer of this document has not independently tested the substance described herein. Users bear sole responsibility for verifying all information, ensuring safe handling, and compliance with all applicable federal, state, provincial, and local regulations. This SDS is not a substitute for independent chemical safety assessment by a qualified professional. This product is intended for scientific research and development use only and is not for human consumption, drug, food, cosmetic, agricultural, or household use.

This SDS complies with GHS Revision 8 / UN GHS Rev.8 and OSHA HazCom 2012 (29 CFR 1910.1200).