**Standard Operating Procedures**

Laboratory Specific

**Chemical:** **Cyanogen Bromide**

Please fill out the form completely.  Print a copy and insert into your

 *Laboratory Safety Manual and Chemical Hygiene Plan*.

Refer to instructions for assistance.

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Department:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_                        Date when SOP was written:\_\_\_\_\_\_\_

Date when SOP was approved by the lab supervisor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Principal Investigator:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Internal Laboratory Safety Coordinator/Lab Manager:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Laboratory Phone:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   Office Phone:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Emergency Contact:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

                                    *(Name and Phone Number)*

Location(s) covered by this SOP:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

                                                *(Building/Room Number)*

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**Type of SOP:** Process Hazardous Chemical Hazardous Class

**Purpose**

Cyanogen bromide is an [inorganic compound](http://en.wikipedia.org/wiki/Inorganic_compound) with the [formula](http://en.wikipedia.org/wiki/Chemical_formula) [CN](http://en.wikipedia.org/wiki/Cyanide)Br. This colorless [crystalline](http://en.wikipedia.org/wiki/Crystalline) compound, similar in appearance to [sugar](http://en.wikipedia.org/wiki/Sugar), is highly [soluble](http://en.wikipedia.org/wiki/Soluble) in water and organic solvents. CNBr is used in organic synthesis, parasiticide, fumigating compositions, rat exterminants, cyaniding reagent in gold extraction process. For selective peptide cleavage, e.g. methionine, and for use in protein immobilisation procedures. Cyanogen bromide must be kept dry at all times. Exposure to moisture results in formation of HCN gas which is highly toxic.

**Physical & Chemical Properties/Definition of Chemical Group**

CAS#: 506-68-3

Class: **Acutely toxic chemical/Corrosive**

Molecular formula: CNBr

Boiling Point: 61 - 62 °C (142 - 144 °F) - lit.

Melting Point:Melting point/range: 50 - 53 °C (122 - 127 °F) - lit.



**Potential Hazards/Toxicity**

**EMERGENCY OVERVIEW:** Appearance: Crystalline powder. colorless

**Target Organs:** Central nervous system, eyes, thyroid, blood.

**Potential Health Effects:**

**Eye:** Causes eye burns, also vapors or mists may be extremely irritating. Cyanide can be absorbed through the eyes causing the symptoms described for inhalation.

**Skin:** May be fatal if absorbed through the skin. Contact with skin causes irritation and possible burns, especially if the skin is wet or moist. Causes symptoms similar to those of inhalation. Skin absorption may cause unconsciousness. Concentrated HCN vapor may also be absorbed through the skin.

**Ingestion:** May be fatal if swallowed. Causes gastrointestinal tract burns. May cause effects similar to those for inhalation exposure. May cause tissue anoxia, characterized by weakness, headache, dizziness, confusion, cyanosis (bluish skin due to deficient oxygenation of the blood), weak and irregular heart beat, collapse, unconsciousness, convulsions, coma and death. Contains cyanide. Human fatalities have been reported from acute poisoning. Large doses of cyanide may result in sudden loss of consciousness and prompt death; small doses will prolong the above symptoms 1 to 2 hours.

**Inhalation:** May be fatal if inhaled. Causes respiratory tract irritation. Inhalation may result in symptoms similar to cyanide poisoning which include tachypnea, hyperpnea (abnormally rapid or deep breathing), and dyspnea (labored breathing) followed rapidly by respiratory depression. Pulmonary edema may occur. Early symptoms include weakness, headache, giddiness, dizziness, confusion, anxiety, nausea and vomiting. In severe cases breathing is rapid and deep then becomes slow and gasping; an irregular heartbeat and tightness in the chest may be experienced.

**Chronic:** There is some evidence that human exposure to the material may result in developmental toxicity. This evidence is based on animal studies where effects have been observed in the absence of marked maternal toxicity, or at around the same dose levels as other toxic effects but which are not secondary non-specific consequences of the other toxic effects.

Long term exposure to high dust concentrations may cause changes in lung function i.e., pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Chronic intoxication with ionic bromides, historically, has resulted from medical use of bromides but not from environmental or occupational exposure; depression, hallucinosis, and schizophreniform psychosis can be seen in the absence of other signs of intoxication. Bromides may also induce sedation, irritability, agitation, delirium, memory loss, confusion, disorientation, forgetfulness (aphasias), dysarthria, weakness, fatigue, vertigo, stupor, coma, decreased appetite, nausea and vomiting, diarrhoea, hallucinations, an acne like rash on the face, legs and trunk, known as bronchoderma (seen in 25-30% of case involving bromide ion), and a profuse discharge from the nostrils (coryza). Ataxia and generalised hyperreflexia have also been observed. Correlation of neurologic symptoms with blood levels of bromide is inexact. The use of substances such as brompheniramine, as antihistamines, largely reflect current day usage of bromides; ionic bromides have been largely withdrawn from therapeutic use due to their toxicity. Several cases of foetal abnormalities have been described in mothers who took large doses of bromides during pregnancy.

Chronic exposure to cyanides and certain nitriles may result in interference to iodine uptake by thyroid gland and its consequent enlargement. This occurs following metabolic conversion of the cyanide moiety to thiocyanate. Thyroid insufficiency may also occur as a result of metabolic conversion of cyanides to the corresponding thiocyanate. Exposure to small amounts of cyanide compounds over long periods are reported to cause loss of appetite, headache, weakness, nausea, dizziness, abdominal pain, changes in taste and smell, muscle cramps, weight loss, flushing of the face, persistent runny nose and irritation of the upper respiratory tract and eyes. These symptoms are not specific to cyanide exposure and therefore the existence of a chronic cyanide toxicity remains speculative. Repeated minor contact with cyanides produce a characteristic rash with itching, papules (small, superficial raised spots on the skin) and possible sensitization. Concerns have been expressed that low-level, long term exposures may result in damage to the nerves of the eye.

**Personal Protective Equipment (PPE)**

**Eyes:** Wear chemical splash goggles.

**Skin:** Wear Natural Rubber, Neoprene, Butyl, PVC or Viton gloves. Any of these glove types are suitable for handling cyanogen bromide. Be sure that you take into account that the gloves are resistant to whatever solvent you are dissolving the cyanogen bromide in. Double-gloving is recommended. Inspect gloves frequently for tears and other breakdown.

**Clothing:** Wear long pants, shirt and closed toed shoes and a lab coat while handling. Try to minimize exposed skin. Please tuck lab coat sleeves into gloves to minimize risk of skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use. A full-face particle respirator type N100

(US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls is recommended. If the respirator is the sole means of protection, use a full-face supplied air respirator recommended.

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by ORS and should contact occhealt@uga.edu. This is a UGA requirement described in more detail in the [UGA Respiratory Protection Plan](https://esd.uga.edu/sites/default/files/respiratoryprotection.pdf) and supported by the [Office of Research Occupational Health and Safety Program](https://research.uga.edu/ohsp/)

**Engineering Controls**

Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction. Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace. If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:

(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks

Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

**First Aid Procedures**

IMPORTANT: ESTABLISH A FIRST AID PLAN BEFORE WORKING WITH CYANIDES. ANTIDOTES SHOULD BE AVAILABLE ON SITE.

**Eyes:** Treat patient as for inhalation. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid immediately.

**Skin:** POISON material. In case of contact, get medical aid immediately. Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.

**Ingestion:** Get medical aid immediately. SPEED IS ESSENTIAL. A DOCTOR MUST BE NOTIFIED AT ONCE. POISON material. If swallowed, get medical aid immediately. Only induce vomiting if directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

**Inhalation:** SPEED IS ESSENTIAL, OBTAIN MEDICAL AID IMMEDIATELY. POISON material. If inhaled, get medical aid immediately. Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Notes to Physician:** Prompt action is essential in all cases of contact. Exposure should be treated as a cyanide poisoning.

Signs symptoms of acute cyanide poisoning reflect cellular hypoxia and are often non-specific. A bradycardia, hypertensive and tachypneic patient suggests poisoning especially if CNS and cardiovascular depression subsequently occurs. Immediate attention should be directed towards assisted ventilation, administration of 100% oxygen, insertion of intravenous lines and institution of cardiac monitoring. Obtain an arterial blood gas immediately and correct any severe metabolic acidosis (pH below 7.15).

Mildly symptomatic patients generally require supportive care alone. Nitrites should not be given indiscriminately - in all cases of moderate to severe poisoning, they should be given in conjunction with thiosulfate. As a temporizing measure supply amyl nitrite perles ( 0.2ml inhaled 30 seconds every minute) until intravenous lines for sodium nitrite are established. 10 ml of a 3% solution is administered over 4 minutes to produce 20% methemoglobin in adults. Follow directly with 50 ml of 25% sodium thiosulfate, at the same rate, IV. If symptoms reappear or persist within 1/2-1 hour, repeat nitrite and thiosulfate at 50% of initial dose. As the mode of action involves the metabolic conversion of the thiosulfate to thiocyanate, renal failure may enhance thiocyanate toxicity. Methylene blue is not an antidote. [Ellenhorn and Barceloux: Medical Toxicology]

If amyl nitrite intervention is employed then Medical Treatment Kits should contain the following:

* One box containing one dozen amyl nitrite ampoules
* Two sterile ampoules of sodium nitrite solution (10 mL of a 3% solution in each)
* Two sterile ampoules of sodium thiosulfate solution (50 mL of a 25% solution in each)
* One 10 mL sterile syringe. One 50 mL sterile syringe. Two sterile intravenous needles. One tourniquet.
* One dozen gauze pads.
* Latex gloves
* A "Biohazard" bag for disposal of bloody/contaminated equipment.
* A set of cyanide instructions on first aid and medical treatment.

- Notes on the use of amyl nitrite:-

* AN is highly volatile and flammable - do not smoke or use around a source of ignition.
* If treating patient in a windy or draughty area provide some shelter or protection (shirt, wall, drum, cupped hand etc.) to prevent amyl nitrite vapor from being blown away. Keep ampoule upwind from the nose, the objective is to get amyl nitrite into the patient's lungs.
* Rescuers should avoid AN inhalation to avoid becoming dizzy and losing competence.
* Lay the patient down. Since AN dilates blood vessels and lowers blood pressure, lying down will help keep patient conscious.
* DO NOT overuse - excessive use might put the patient into shock. Experience at DuPont plants has not shown any serious after-effects from treatment with amyl nitrite.

**Antidote:** For cyanide poisoning, administer cyanide antidote kit (contains amyl nitrite, sodium nitrite and sodium thiosulfate).

* Major medical treatment procedures may vary e.g. US (FDA method as recommended by DuPont) uses amyl nitrite as a methemoglobin generator, followed by treatment with sodium nitrite and then sodium thiosulfate.

MODES OF ACTION: Amyl nitrite (AN) reacts with hemoglobin (HB) to form about 5% methemoglobin (MHB). Sodium nitrite (NaNO2) reacts with hemoglobin to form approximately 20-30% methemoglobin. Methemoglobin attracts cyanide ions (CN) from tissue and binds with them to become cyanmethemoglobin (CNMHB). Sodium thiosulfate (Na2S2O3) converts cyanmethemoglobin to thiocyanate (HSCN) which is excreted by the kidneys. i.e. AN + HB = MHB NaNO2 + HB = MHB CN + MHB = CNMHB Na2S2O3 + CNMHB + O2 = HSCN

* The administration of the antidote salts is intravenous in normal saline, Ringers lactate or other available IV fluid.

**Special Handling and Storage Requirements**

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Acids should not be used around cyanogen bromide unless absolutely necessary and then only after careful planning. Hydrogen cyanide (HCN) formation is the greatest potential hazard in using cyanogen bromide solutions because some HCN gas will be released. Use only with adequate ventilation or respiratory protection.

**Storage:** Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Store protected from moisture, inside a dessicator is recommended. Poison room locked. Keep away from acids. It is recommended that if you store cyanogen bromide in a cold location that you should allow the bottle to reach room temperature before opening. Opening a bottle while still cold may result in condensation which will allow the chemical to react with water and thereby releasing HCN gas.

**Spill and Accident Procedure**

**Chemical Spill Dial 911**

**24-7 On-Call Response to Research, Environment, Health or Safety Concerns Dial 2-5561 from a campus phone or 706-542-5561 from a non-campus line.**

**Spill** – Follow the procedures set out in the [UGA Chemical and Laboratory Safety Manual.](http://research.uga.edu/docs/units/safety/manuals/Chemical-Laboratory-Safety-Manual.pdf)

[If there are any chemical-specific protocols for responding to a spill, insert them here or mark “none”:]

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# **Medical Emergency Dial 911**

**Life Threatening Emergency, After Hours, Weekends And Holidays** – Dial **911** or the emergency phone numbers listed at the beginning of the UGA Chemical and Laboratory Safety Manual

*Note: All incidents that result in an injury or property damage must be reported to ORS / ESD using a University Incident/Accident Report.*

**Non-Life Threatening Emergency** – Follow the instructions in the UGA Chemical and Laboratory Safety Manual.

*Note: All incidents that result in an injury or property damage must be reported to ORS / ESD*

*using a University Incident/Accident Report.*

**Decontamination/Waste Disposal Procedure**

**For general hazardous waste disposal procedures, see Appendix H of the UGA Chemical and Laboratory Safety Manual.**

**Chemical Specific Procedures: [to be inserted or marked as “none”]**

**Safety Data Sheet (SDS) Location**

UGA personnel can access Online SDS through a link in the upper left corner of the ESD home page (<https://esd.uga.edu>) and logging in by using their UGA email user name and password.

**Protocol/Procedure**

*(Add specific description of procedure.)*

**Note:** Any deviation from this SOP requires written approval from PI.

**Documentation of Training** *(signature of all users is required)*

* Prior to conducting any work with colchicine, designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
* The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and access to the SDS provided by the manufacturer.
* The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training within the last 12 months.

I have read and understand the content of this SOP:

|  |  |  |
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| **Name** | **Signature** | **Date** |
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