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भारतीय मानक मसौदा

सोडियम सायनाइड — सुरक्षा संहिता

Draft Indian Standard

Sodium Cyanide — Code of Safety

ICS 71.060.50

Chemical Hazards Sectional Committee, CHD 07	**Last date for Comments: 20th October 2025**

FOREWORD

(*Formal clause to be added later*)

Sodium cyanide is white solid. It releases hydrogen cyanide gas, a highly toxic chemical asphyxiant that interferes with the body's ability to use oxygen. Exposure to sodium cyanide can be rapidly fatal. It has whole-body (systemic) effects, particularly affecting those organ systems most sensitive to low oxygen levels: the central nervous system (brain), the cardiovascular system (heart and blood vessels), and the pulmonary system (lungs). Sodium cyanide is used commercially for fumigation, electroplating, extracting gold and silver from ores, and chemical manufacturing.

The elimination of accidents is vital to public interest. Accidents produce economic and social loss and impair individual or group productivity. Realization of this loss has led the authorities to devote a good deal of attention to safety education. In any programmed of safety education, preparation of code of safety is an essential part. Apart from general precautions, some typical precautions are required to be taken and this code of safety lays special emphasis on these points. For, proper utilization of the code of safety for sodium cyanide, a knowledge of effects of hazardous substances on biological systems is desirable.

This code of safety recommends practices to be followed to ensure safety of personnel engaged in industries where sodium cyanide is produced, stored, handled or used. It also recommends safety measures for controlling hazards and essential information on symptoms of poisoning, first-aid, medical treatment, storage, handling, labelling and employee safety.

The properties of sodium cyanide listed in clause **4** have been taken from literature and have been included for information only. Moreover, these properties pertain to carbon tetrachloride. BIS has published a separate standard IS 11782 : 2024 on the requirements and the methods of sampling and test for sodium cyanide, technical and IS 6358 : 2024 on requirements and methods of sampling and test for sodium cyanide for electroplating.

There is no standard on this subject published by ISO. This standard has been prepared indigenously based on the available data and information.

The various clauses of the standard have been aligned with the format being applied for all Indian Standards on code of safety of chemicals.

1 SCOPE

1.1 This standard prescribes general properties of sodium cyanide, solid and the nature of hazards associated with it.

1.2 This standard also covers other essential information such as information on storage, handling, packing, labelling, disposal of waste, cleaning and repair of containers, selection and training of personnel, protective equipment and first-aid.

1.3 This standard does not deal with specification for design of buildings, chemical engineering plants, storage vessels, equipment for operations control and waste disposal.

2 REFERENCES

The Standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 4155 shall apply.

4 PROPERTIES

4.1 General Information

White solid sodium cyanide is a salt of a weak acid and is easily hydrolysed by water and may release highly toxic gases. It exhibits reactivity with water and readily absorbs carbon dioxide from the atmosphere, resulting in the release of highly toxic and flammable hydrogen cyanide (HCN) gas. It reacts violently with fluorine gas, magnesium, nitrates, nitric acid, strong oxidizing agents, and acidic substances. Elevated temperatures can lead to the liberation of ammonia gas. Contact with acids or acid fumes poses significant hazards, producing toxic and flammable vapors, including hydrogen cyanide and sodium oxide. Sodium cyanide is highly hazardous and must not be physically contacted or ingested.

4.1.1 *Chemical Name* — Sodium Cyanide

4.1.2 *Common Name and Synonyms* **—** Hydrocyanic acid, sodium salt, Prussiate of soda, cyanide of sodium.

4.1.3 *Uses*

White crystalline Sodium cyanide (NaCN) is extensively utilized for the extraction of gold and silver through the cyanidation process, electroplating, chemical synthesis, metal hardening, and to produce dyes and pigments. It is also used as a critical reagent for organic synthesis in laboratory and industrial application. Cyanide and cyanide-containing compounds are used in pesticides and fumigants, plastics, and mining. Some industrial processes, such as iron and steel production, chemical industries and wastewater treatment may produce cyanides.

4.2 Identification

4.2.1 *Formula* — NaCN

4.2.2 *CAS Number* — 143-33-9

4.2.3 *UN Number* — 1689

4.2.4 *UN Class* — 6.1

4.3 Physical Properties

4.3.1 *General*

Sodium cyanide is a white crystalline powder. It is hygroscopic in nature and is odourless when dry and has faint bitter almond-like odour in presence of moisture and air.

4.3.2 *Molecular Mass* — 49.007 2 g/mol

4.3.3 *Physical State* — Solid crystalline

4.3.4 *Colour* — White

4.3.5 *Odour* — Odourless when dry and have faint bitter almond-like odour in presence of moisture and air.

4.3.6 *Boiling Point* — 1 497 °C

4.3.7 *Melting Point* — 563 °C

4.3.8 *Vapour Density (Air=1)* — Not applicable

4.3.9 *Specific Gravity*

4.3.9.1 *Solid (water = 1) at 20 °C* — 1.546

4.3.9.2 *Liquid (30 percent solution (w/v) (water =1)* — 1.16 to 1.19 at 25 °C

4.3.10 *Viscosity (30 percent solution (w/v) at 30 °C* — 7.6 mPa.s

4.3.11 *Vapour Pressure* — 1 mm Hg at 817 °C

4.3.12 *Heat of Combustion* — Not applicable

4.3.13 *Refractive Index* — 1.452 at 25 °C

4.3.14 *Solubility in Water* — Highly soluble in water (48 g/100 ml at 10 °C; 58 g/100 ml at 20 °C; 82 g/100 ml at 35 °C).

4.3.15 *Solubility in Other Solvents*

Sodium cyanide is soluble in ammonia, methanol, ethanol, slightly soluble in dimethylformamide. Sodium cyanide is insoluble in non-polar solvent such as benzene, hexane due to its ionic nature. It has moderate solubility in some polar aprotic solvents, which may be used in organic synthesis reactions, particularly in nucleophilic substitution processes.

4.3.16 *Light Sensitivity*

It is light sensitive and may release hydrogen cyanide when exposed to light.

4.4 Chemical Properties

4.4.1 *Reactivity*

Sodium cyanide reacts mildly with water and absorbs carbon dioxide from the air, liberating highly toxic and flammable hydrogen cyanide gas. It reacts violently with fluorine gas, magnesium, nitrates, and nitric acid, strong oxidizing and acidic agents. Ammonia gas is liberated at elevated temperatures. Contact with acids or acid fumes can produce toxic and flammable vapours, including hydrogen cyanide and sodium oxide. It is hygroscopic in nature, and it may absorb water when comes in contact with air. It is incompatible with strong oxidizing agents and react violently with strong oxidants such as nitrates, chlorates, nitric acid and peroxide, posing an explosion hazard. Sodium cyanide has a high affinity for metals, particularly gold and silver. Cyanide is a strong nucleophile, meaning it readily donates electrons to form new chemical bonds. Sodium cyanide can react with iron salts to form stable, soluble compounds like sodium ferrocyanide.

4.4.2 *Polymerisation* — Not applicable

4.4.3 *Allotrope formation* — Not applicable

4.4.4 *Corrosion properties*

Sodium cyanide is corrosive in nature when it comes in contact with acids, water, moisture, carbon dioxide, or acid salts, and will produce hydrogen cyanide gas. The sodium cyanide solution can corrode aluminium and zinc metal.

4.5 Fire and Explosion Hazard Properties

4.5.1 *Ignition Temperature* — Not applicable

4.5.2 *Auto Ignition Temperature* — Not applicable

4.5.3 *Flash Point* — Not applicable

4.5.4 *Upper Explosive Limit* — Not applicable

4.5.5 *Lower Explosive Limit* — Not applicable

4.5.6 *Fire Risk*

Sodium cyanide solid is not combustible itself, but it can pose fire and explosion hazards due to its reaction with certain substances. It is not flammable itself, but it can release toxic, flammable hydrogen cyanide gas when it reacts with acids, acid salts, water, moisture, or even carbon dioxide from the air. Additionally, it can react violently with strong oxidants, potentially leading to explosions.

5 HEALTH HAZARD & TOXICITY INFORMATION

5.1 General Information

Solid sodium cyanide is a highly toxic chemical that poses significant health risks upon exposure. It releases hydrogen cyanide gas, a potent chemical asphyxiant that interferes with the body's ability to utilize oxygen. Sodium cyanide is a white crystalline powder characterized by high toxicity, posing significant acute and chronic health risks. It can adversely affect the respiratory system, thyroid function, cardiovascular health, nervous system, and blood composition. It may also cause eye irritation. Exposure through routes such skin, inhalation, or ingestion, may be fatal. It is necessary to have appropriate precautions to avoid exposure.

5.2 Routes of entry

Regardless of the route of entry, sodium cyanide interferes with the body's ability to utilize oxygen at the cellular level, particularly affecting the central nervous system, cardiovascular system, and respiratory system. Exposure can be rapidly fatal, highlighting the importance of understanding and avoiding all potential routes of entry.

5.2.1 *Skin*

Exposure to sodium cyanide may cause irritation, redness, pain, rash, dermatitis. Skin contact may be fatal.

5.2.2 *Eyes*

Sodium cyanide may cause severe irritation, lacrimation, pain and redness to the eyes on direct contact. Vapours or mist of sodium cyanide are extremely irritating.

5.2.3 *Ingestion*

Sodium cyanide ingestion causes severe damage to intestinal tract. Symptoms may include burning sensation, a bitter, pungent burning taste in the mouth, abdominal pain, nausea, vomiting, diarrhoea and possible burns. It could be fatal.

5.2.4 *Inhalation*

Avoid exposure of sodium cyanide fumes, mist, vapours or spray. It may cause respiratory tract irritation and effect could be fatal. Breathing in sodium cyanide dust or the highly toxic hydrogen cyanide gas it releases when exposed to acids, acid salts, water, moisture, or carbon dioxide. Inhalation can cause symptoms within seconds or minutes, leading to rapid poisoning.

5.2.5 *Long term effects*

Exposure to sodium cyanide may damage nervous system, thyroid gland and has the ability to cause cancer in animals. Long term exposure will cause chronic disease of lungs and heart.

5.3 Toxicity information

a) Threshold Limit Value-Time-weighted average [TLV (TWA)] — 1 mg/m^3 over each 8 h of 40 h working week.

b) Short-Term Exposure Limit (STEL) — 5 mg/m^3 for 15 min.

c) Immediately Dangerous to Life or Health (IDLH) — 25 mg/m^3

d) Lethal Concentration (LC_{50}) (rat), inhalation — 63 ppm for 1 h

e) Oral LD_{50} (rat) — 5.733 mg/kg

f) Dermal LD_{50} (rabbit) — 14.602 mg/kg

5.4 Antidote

The primary antidotes for sodium cyanide poisoning include oxygen, sodium thiosulfate and hydroxycobalamin. Oxygen serves as the most effective treatment for sodium cyanide poisoning, as it facilitates the reactivation of cytochrome oxidase, counteracting the inhibitory effects of cyanide. Antidote shall be given on medical advice. Seek medical help in case exposure.

5.5 Health Effects

5.5.1 *Signs and Symptoms*

Exposure to sodium cyanide may cause irritation of eyes, abdominal pain, nausea, skin burn, dermatitis, rash, breathing difficulties, death from respiratory arrest.

5.5.2 *Acute Toxicity*

5.5.2.1 *Systemic effects*

Sodium cyanide if swallowed can cause damage to the gastrointestinal tract, along with burning sensation, a bitter, pungent burning taste in the mouth, abdominal pain, nausea, vomiting, diarrhoea and possible burns. The presence of a bitter almond odour may be observed on an individual's breath or in vomit. Ingesting high concentrations of certain substances can result in symptoms akin to those associated with inhalation exposure. Significant doses may lead to an abrupt loss of consciousness and potentially result in death due to respiratory failure. Additionally, smaller yet still lethal doses may prolong the illness for one or more hours.

5.5.2.2 *Local effects*

Sodium cyanide, upon contact with the skin, can result in irritation, burns, and poisoning if absorbed. Exposure to the eyes may lead to severe irritation or potential corneal damage. When sodium cyanide reacts with moisture or acids, it liberates hydrogen cyanide gas. Hydrogen cyanide gas can irritate the respiratory system and can cause coughing, wheezing, and difficulty in breathing, if inhaled.

5.5.3 *Chronic Toxicity*

Prolonged exposure, even at low levels, may damage to vital organs, including the nervous system, liver, and kidneys. Symptoms of chronic toxicity include persistent fatigue, headaches, dizziness, shortness of breath, and neurological issues such as tremors or difficulty in concentrating. Additionally, prolonged exposure may affect thyroid function, leading to goitre or hypothyroidism. Repeated skin contact or inhalation of vapours can also cause irritation, desensitization, and systemic absorption, increasing the risk of cumulative health impacts.

6 PERSONAL PROTECTIVE EQUIPMENT

6.1 Availability and Use

6.1.1 While personal protective equipment is not an adequate substitute for safe working conditions, adequate ventilation and intelligent conduct on the part of employees working with bromine, it is in many instances, the only practical means of protecting the worker, particularly in emergency situations. Personal protective equipment protects only the worker wearing it, and other unprotected workers in the area may be exposed to danger.

6.1.2 The correct usage of personal protective equipment requires the education of the worker in proper employment of the equipment available to personnel.

6.1.3 Under conditions which are sufficiently hazardous to require personal protective equipment, its use should be supervised and the type of protective equipment selected should be capable of control over any potential hazard.

6.2 Non-Respiratory Equipment

6.2.1 *Eye and Face Protection*

Safety glasses with side shields are essential when working with dry sodium cyanide. For working with sodium cyanide solutions, especially concentrations greater than 1 percent, splash goggles should be used. A face shield can be used in combination with goggles when there's a potential splash hazard. The appropriate eye and face protection shall be used while handling sodium cyanide as specified in IS 8520.

6.2.2 *Head Protection*

‘Hard' hats should be worn where there is danger from falling objects. If hard hats are not considered necessary, soft-brimmed hats or caps may be worn to give protection against overhead leaks. Safety helmets (*see* IS 2925) should be worn where there is danger from falling objects. Soft-brimmed hats or caps should be used to protect against potential liquid leaks or splashes.

6.2.3 *Foot and Leg Protection*

The personnel handling solid sodium cyanide should wear butyl rubber safety footwear (*see* IS 15298 (Part 2). Other materials like nitrile, neoprene, are also suitable, but butyl rubber is generally considered the best due to its high resistance to a wide range of chemicals, including cyanides. Closed-toe shoes made of these materials, offering good coverage and protection, are crucial.

6.2.4 *Body, Skin and Hand Protection*

Long pants or clothing that covers the body to the ankles and closed-toe solid top shoes must be worn when handling cyanide salts. Lab coats must be worn. If working with larger amounts where a splash to the body/arms is possible, then additional body protection should be worn, i.e., chemical resistant apron, oversleeves, etc. Suits made of butyl and neoprene rubber or suitable impervious protective material and properly designed, should be used wherever complete body protection (*see* IS 8519) is necessary.

6.3 Respiratory Equipment

Respirator selection (upper limit devices):

a) 5 mg/m^3 — Use a full-facepiece air respirator in pressure-demand or positive-pressure mode. For added protection, combine it with an auxiliary self-contained breathing apparatus in the same mode (*see* IS 15803).
b) For more than 5 ppm and unknown concentration use self-contained breathing apparatus [*see* IS 10245 (Part 1) and IS 10254 (Part 2)].

7 STORAGE, HANDLING, LABELLING AND TRANSPORT

7.1 General

7.1.1 All personal handling sodium cyanide should use proper personal protective equipment. Appropriate firefighting equipment should be available in the vicinity while handling sodium cyanide. Persons handling nitrobenzene should have adequate training in use of firefighting equipment.

NOTE — The storage shall be as per the criteria given in the relevant schedule of the *manufacture, storage and import of Hazardous Chemicals Rules,* 1989. While referring to the statutes, the stipulations given in the latest amendments of those statutes shall be taken into account.

7.1.2 The manufacturer/producer of t carbon tetrachloride shall issue material safety datasheet (MSDS) for all its user for comprehensive safety details. The MSDS shall be in format as prescribed in IS 17889. MSDS translation in local languages may be provided as required.

7.2 Storage

7.2.1 Sodium cyanide tanks should typically be constructed from chemical-resistant materials, such as stainless steel or high-grade specialty plastics, to prevent leakage and chemical reactions.

7.2.2 Sodium cyanide storage tanks should be grounded and protected from sunlight exposure. The combustible material should not be stored in sodium cyanide storage area.

7.2.3 Storage tanks may be of concrete or welded steel. There shall be no bottom or side outlets in storage tanks. The storage tanks should be placed in retaining basins, also to be constructed of concrete or welded steel, without bottom or side outlets. The basins should be adequate to the full load of the storage tank. Retain valves should be provided in the storage area. Water hydrants may be provided near storage area.

7.2.4 Sealed tanks should be equipped with rupture discs and safety valves set to release at a predetermined pressure. End of pressure relief line should open under water. An ample safety factor should be allowed to protect the tank itself. There should be proper ventilation where sodium cyanide is stored or handled inside building. Under abnormal circumstances special emergency ventilating equipment such as fans or blowers may be necessary.

7.2.5 Sodium cyanide should be stored in a cool, dry, well ventilated place, in a special locked storeroom and out of direct sunlight.

7.2.6 Sodium cyanide should not be stored in any place where acidic gases may be generated or, acid, nitrates or nitrites are stored.

7.2.7 When the package is not opened, no special ventilation equipment is required. But avoid long term storage once sodium cyanide is dissolved or comes directly into contact with air.

7.2.8 The storage tanks should be equipped with robust sealing systems to prevent any potential leakage, ensuring that the toxic substance remains safely contained under all conditions.

7.2.9 The storage facilities should have ventilation mechanism to relieve internal pressure, minimizing the risk of explosion.

7.3 Handling

7.3.1 *General*

7.3.1.1 Each consignment should be unloaded carefully to prevent damage. Each container should be examined carefully for leaks. If anyone found, it should be handled with particular care to prevent further leakage and removed to a safe place where the leak can be stopped or contents transferred to another container. The general handling practices given in **7.3.1.2** to **7.3.1.5** should be followed.

7.3.1.2 All handlers should be aware of the potential hazards of sodium cyanide and of appropriate first-aid measures.

7.3.1.3 If there is significant risk of exposure an operator should not handle sodium cyanide without available assistance in the area.

7.3.1.4 The handling area should be such an easy-to-wash concrete floor.

7.3.1.5 Sodium cyanide should be handled in inert gas in a well-ventilated area, ideally a fume hood. Avoid inhaling dust, fumes, or vapors, and prevent contact with eyes, skin, or clothing.

7.4 Labelling (product standard)

Each container (including tankers) should carry an identifying label or stencil as depicted in and Fig. 11 of IS 1260 (Part 1) or Label Model No. 6.1 of Annex B of IS 18149. The storage containers shall be labelled or marked to identify as follows:

a) The name of the material and its net mass;

b) Name of the manufacturer and recognized trade-mark, if any;

c) Lot number, drum number and date of manufacture;

d) The word ‘POISON’ and the appropriate symbol; and

e) Physical, chemical and toxicological data as per the criteria given in the relevant schedule of the manufacture, storage and import of *Hazardous Chemicals Rules*, 1989. While referring to the statutes, the stipulations given in the subsequent amendments of those statutes shall be taken into account.

7.5 Transport

7.5.1 Vehicle driver should be aware of the potential hazards of the load and should know standard procedure (do’s and don’ts) in the event of an accident or an emergency.

7.5.2 The driver should be familiar with the truck and the ISO-container; it’s length, width, maximum speed, height, braking, turning circle etc.

7.5.3 The driver should carry TREM card when vehicle is on road.

7.5.4 The driver should not board the passengers in transport units carrying dangerous goods.

7.5.5 The Driver and his crew should be aware about the necessary requirements for fire-fighting.

7.5.6 The drivers should be prohibited from opening the packages containing dangerous goods.

7.5.7 The engine shall be shut off during loading and unloading operations.

7.5.8 Transport on vehicles where the load space is not separated from the driver's compartment should be avoided. Before transporting product containers, adequate ventilation, tightly closed and firmly secured containers with correctly fitted valve cap and protective device (where provided) should be ensured.

NOTE — If transport of the hazardous chemical is involved it shall be carried out in accordance with the *Central Motor Vehicles Rules*, 1989. While referring to the statutes, the stipulations given in the subsequent amendments of those statutes shall be taken into account.

8 SPILLAGE, LEAKAGE AND WASTE DISPOSAL

8.1 General

All personnel attending to spill/leak should use proper personal protective equipment and fire-fighting equipment like alcohol or polymer foam extinguishers on a fire while handling sodium cyanide.

8.2 Spillage

8.2.1 *General Information*

Sodium cyanide should be stored in a secured, cool, dry, and well-ventilated facility, away from direct sunlight, incompatible substances, and occupied work areas. The containers should be airtight, corrosion-resistant, and clearly labelled, with measures in place to prevent dust accumulation. The storage areas should be free from fire hazards, flammable materials, and sprinkler systems, as water interaction may result in hazardous runoff. Theres should be adequate ventilation is essential to maintain cyanide concentrations below permissible exposure limits, with warning signage displayed as appropriate. There should be routine inspections to identify leaks, damage, or other deficiencies. Monitor aqueous solutions for ammonia pressure build-up, and treat empty containers as hazardous due to potential residue. Storage quantities should be minimized, and all safety protocols strictly adhered to.

8.2.2 *Land Spill (Spill on land)*

Sodium cyanide (NaCN) is a highly toxic substance commonly used in industries such as gold extraction. Spills on land poses significant threats to human health and the environment due to its toxicity and potential to react with water and acids, releasing highly toxic and flammable hydrogen cyanide gas.

8.2.2.1 *Containment*

In case of land spill, first secure the area and prevent the unauthorized access. There should adequate ventilation in the area to minimize build of hydrogen cyanide. The spill should be neutralized by chlorination, using sodium hypochlorite solution, or by oxidation with hydrogen peroxide or peroxysulfuric acid. Measures should be implemented to prevent dust accumulation and to avoid exposure to fire hazards, flammable materials, and water sources that could lead to hazardous runoff. The spilled material should be collected carefully using dry methods (like vacuuming or sweeping) and place it in sealed containers for proper disposal. Prevent runoff from entering drains, sewers, or watercourses to avoid contaminating water systems.

8.2.2.2 *Consequence*

Improper containment of sodium cyanide can lead to toxic gas release, environmental contamination or exposure to moisture or incompatible materials may cause hazardous reactions, emphasizing the need for secure, airtight storage and strict safety measures. Sodium cyanide can persist in the environment, contaminating soil and water sources. Accidental spills can have devastating effects on ecosystems, including fish kills, contamination of drinking water supplies, and harm to agricultural lands. Cyanide contaminated groundwater can also persist for extended periods and pollute connected waterways.

8.2.2.3 *Mitigation*

The spilled material should be collected after wearing appropriate PPEs, and kept it in double-bagged with liner, and sealed. It shall be disposed as per hazardous waste management rules. Contaminated sodium cyanide should not be used. In case of a large spill, evacuate the area immediately. Contaminated equipment and materials should be decontaminated using appropriate methods and disposed of as hazardous waste in accordance with regulations.

8.2.3 *Water Spill (Spill in Water)*

Sodium cyanide is a weak acid salt and gets easily hydrolysed by water to form highly toxic gas. For a water spill involving sodium cyanide, immediately contain the spill using barriers to prevent spread. There should be proper ventilation to minimize hydrogen cyanide gas release and direct runoff into a secure containment area. The contaminated materials should be collected, double-bagged, labelled, and disposed of following hazardous waste guidelines. If spillage occur in large water bodies, decontaminate chemically and contaminated water should not be used till it has been decontaminated completely. Contain the spill using absorbent materials like vermiculite, dry sand, or earth to prevent it from spreading.

8.3 Leakages

8.3.1 *General Information*

All personal attending to spill/leak should isolate the affected area and restrict access to authorized personnel equipped with appropriate personal protective equipment (PPE), including gloves, goggles, and a breathing apparatus. The direct contact with the substance or inhalation of fumes should be avoided. For smaller spills, cover the area with an inert material such as dry sand and sweep it up.

8.3.2 *Leak from the Truck*

If sodium cyanide leak from a truck, immediate action should be taken to ensure the safety of personnel and the surrounding environment. Isolate spill or leak area in all directions for at least 25 m for solids. Neutralise and dispose using ferrous sulphate, followed by bleaching powder or sodium hypochlorite solution. Toxic gas can evolve during neutralisation. Waste cyanide solutions must be neutralised and not allowed to be discharged directly into sewers, drains or water courses.

8.4 Waste Disposal

8.4.1 Excess sodium cyanide and waste materials containing this substance should be carefully contained in an appropriate, clearly labelled container. The waste disposal shall be done as per the *Hazardous and other Waste (management and transboundary movement) Rules*, 2016.

8.4.2 Sodium cyanide should be prevented from entering drains, watercourses, or soil to avoid environmental contamination and comply with safety requirement.

9 FIRE PREVENTION AND FIRE FIGHTING

9.1 General

The personnel should wear appropriate protective clothing to prevent skin and eye contact, and wear suitable self-contained breathing apparatus (SCBA) to mitigate exposure to sodium cyanide vapour and toxic gases. Sodium cyanide is non-combustible but may decompose under heat, releasing toxic and corrosive fumes. Runoff from fire suppression or dilution water may result in environmental contamination.

9.2 Prevention

The fire extinguishers having carbon dioxide should not be used to put out fire. Fires involving sodium cyanide should be extinguished with a water spray or fog, avoiding the use of a direct stream of water. The use of foam is not recommended, as it may react with sodium cyanide, releasing toxic and corrosive fumes. For small fires, dry chemical extinguishers or dry sand should be utilized to suppress the fire effectively.

9.3 Fire fighting

Fire fighters should wear proper PPEs and suitable self-contained breathing apparatus (SCBA) while handling fire in sodium cyanide areas.

10 TRAINING

10.1 Safety in handling sodium cyanide depends upon the effectiveness of employee education, training and supervision. The education and training of employees to work safely and to use the personal protective equipment and other safe guards provided for them is a responsibility of supervisor. Employee education and training should emphasize the need of handling sodium cyanide according to the methods outlined in the manual, in order to avoid spilling or splashing, leaks, burns, inhalation of the vapour of burning material, or ingestion. Unauthorised and untrained employees should not be permitted in areas where sodium cyanide is being handled. Firefighters should wear self-contained breathing apparatus and full protective gear while fire-fighting. The work permit shall be issued as per format prescribed in IS 17893.

10.2 Before being placed on the job, all new employees should be instructed thoroughly for the proper handling of sodium cyanide. Older employees should be re-instructed periodically.

10.3 Each employee should know the location, purpose and maintenance of personal protective equipment (PPEs) and be thoroughly trained when and how to use it. Each employee should know the location of safety showers, fountains for flushing the eyes, and hose lines.

10.4 Only reliable, dependable and properly trained employees should be given the responsibility of all operations involving storage, handling, transport and emergency management involving sodium cyanide.

10.5 Employee should be trained to report to the proper authority about all suspected leaks or equipment failure.

10.6 They should be instructed to inform to supervisors any signs of illness or skin related problems.

10.7 Each employee should know what to do in emergency and the first-aid measures and should realize the necessity for the prompt application of first aid in case of contact with sodium cyanide or exposure to the vapours of the burning material.

11 HEALTH MANAGEMENT, FIRST-AID AND MEDICAL TREATMENT

11.1 Health Monitoring

11.1.1 *Personal Hygiene*

Employees should bath daily after finishing the work and always use protective gloves when handling solid sodium cyanide. They should also report any abnormal condition of the mouth, skin or eye to medical department.

11.1.2 *Physical Examination*

11.1.2.1 *Pre-placement physical examinations*

Pre-placement medical examination should be done, and record should be maintained.

11.1.2.2 *Periodic examination*

Periodic examination should be done, and record should be maintained

11.2 First Aid

11.2.1 *General Principles*

Immediate first aid should be given when exposed. The vomiting should be avoided, if cyanide has been ingested. Avoid exposure to blood or body fluids. Wear gloves and other necessary protective clothing. Dispose of contaminated clothing and equipment as bio-hazardous waste. Give the physician a detailed account of the accident. Given its hazardous nature, it is imperative to implement prompt first aid measures and appropriate safety protocols to mitigate the risk of significant local and systemic injury.

11.2.2 *Contact with Skin*

In the case of contact with skin, rinse immediately with plenty of water. Immediate action is critical to prevent irritation and potential systemic absorption. Remove any contaminated clothing carefully to avoid spreading the substance, and thoroughly rinse the affected area with plenty of water for at least 15 min, avoiding vigorous scrubbing to reduce the risk of increased absorption. Rescuers should wear gloves or other protective equipment to prevent secondary exposure during assistance. Even if no symptoms are immediately apparent, medical attention should be sought promptly, as systemic effects from cyanide absorption can develop rapidly and may be life-threatening. Rescuers should use appropriate protective equipment to avoid secondary exposure.

11.2.2.1 *Caution*

Sodium cyanide is an extremely hazardous substance that must be handled with utmost care due to its high toxicity. Even small exposures can be fatal, making strict precautions essential. Inhalation of its dust or fumes can lead to severe respiratory failure, while skin or eye contact can cause irritation and allow the substance to be absorbed into the body. When in contact with acids or moisture, sodium cyanide releases hydrogen cyanide gas, a highly toxic compound. It should be stored in tightly sealed containers in a dry, well-ventilated area, away from acids and incompatible materials. Proper personal protective equipment (PPE), including gloves, goggles, and respiratory protection, is critical to ensure safe handling and minimize risks.

11.2.3 *Contact with Eyes*

If sodium cyanide comes into contact with the eyes, it is a medical emergency that requires immediate action. Begin by flushing the eyes with plenty of water for at least 15 min, ensuring that the eyelids are held open to allow thorough rinsing. Avoid using any chemicals or ointments unless directed by medical personnel. Seek urgent medical attention, even if no symptoms are immediately apparent, as sodium cyanide exposure can cause severe damage to the eyes and pose systemic risks due to potential absorption. Rescuers should use appropriate protective equipment to avoid secondary exposure.

11.2.4 *Ingestion*

Sodium cyanide is highly toxic if ingested may causes corrosive damage to the gastrointestinal tract. Clinical manifestations may include a burning sensation, a bitter, pungent taste in the mouth, abdominal pain, nausea, vomiting, diarrhoea, and potential burns. The presence of a bitter almond odour may be noted on the breath or in the vomitus. Ingestion of high concentrations may result in symptoms similar to those associated with inhalation exposure, with large doses potentially leading to rapid loss of consciousness and death due to respiratory arrest. Smaller, yet still lethal doses, may cause prolonged illness lasting several hours.

11.2.5 *Inhalation*

Immediate action is critical in cases of sodium cyanide exposure due to its extreme toxicity. If the substance is inhaled, move the affected individual to a well-ventilated area, administer oxygen. Keep the patient warm and at

rest, and if breathing has stopped, apply artificial respiration using devices such as an air-viva, oxy-viva, or a one-way mask to safeguard the rescuer. Avoid direct mouth-to-mouth resuscitation. Promptly remove contaminated clothing, store it in open air, and wash thoroughly before reuse. If oxygen is unavailable and the patient is conscious, administer amyl nitrite by breaking a capsule onto a cloth and allowing the patient to inhale it for 15 seconds to 30 seconds every 2 min to 3 min until the capsule is depleted, using a maximum of six capsules. All procedures should be conducted in a well-ventilated area to minimize risk to responders. Seek medical assistance without delay.

11.2.6 *First-Aid Kit*

A first aid kit should be provided in work area as specified in **B-4** of IS 11782.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 1260 (Part 1) : 1973	Pictorial markings for handling and labelling of goods Part 1 Dangerous goods (*first revision*)
IS 2925 : 1984	Specification for industrial safety helmets (*second revision*)
IS 4155 : 2023	Glossary of terms relating to chemical and radiation hazards and hazardous chemicals (*first revision*)
IS 8519 : 2024	Guide for selection of occupational protective clothing — Body protection (selection, care, and maintenance) (*first revision*)
IS 8520 : 2023/ ISO 19734 : 2021	Eye and face protection — Guidance on selection, use, and maintenance (*first revision*)
IS 10245 (Part 1) : 1996	Breathing apparatus Part 1 Closed circuit breathing apparatus (compressed oxygen cylinder) — Specification (*first revision*)
IS 10245 (Part 2) : 2023	Respiratory protective devices — Specification Part 2 Self-contained open circuit breathing apparatus (*second revision*)
IS 11782 : 2024	Sodium Cyanide, Technical — Specification (*first revision*)
IS 15298 (Part 2) : 2024	Personal protective equipment Part 2 Safety footwear (*third revision*) (MOD ISO 20345 : 2021)
IS 15803 : 2008	Respiratory protective devices — Self-contained closed circuit breathing apparatus chemical oxygen (KO_2) type, self-generating, self-rescuers — Specification
IS 17889 : 2022	Material Safety Data Sheets — Guidelines
IS 17893 : 2023	Work Permit System — Code of Practice
IS 18149 : 2023	Transportation of dangerous goods – Guidelines