



INDIAN STANDARDS ON **SAFETY AND HAZARDS IN PROCESS INDUSTRIES**

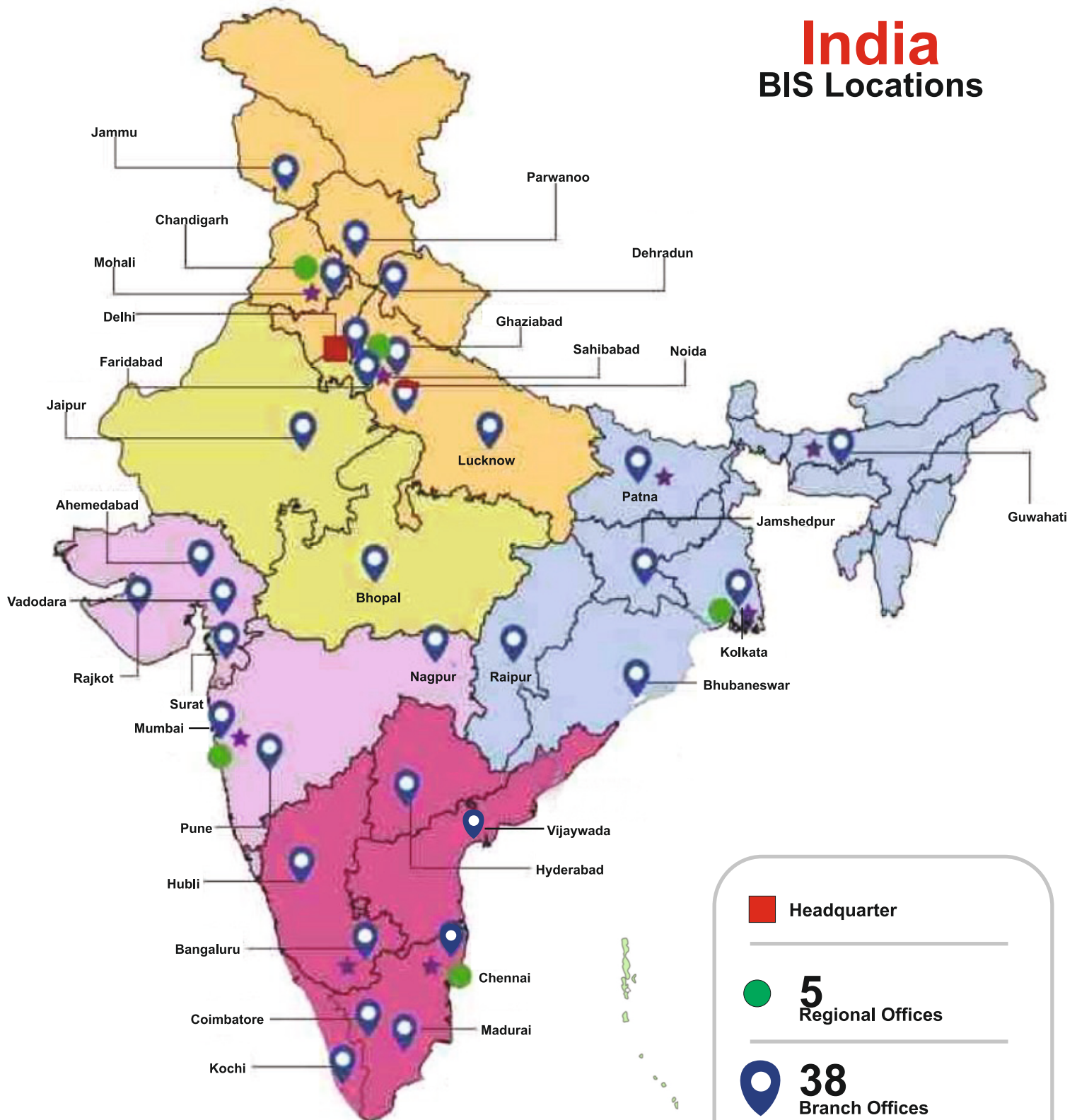
BUREAU OF INDIAN STANDARDS
Ministry of Consumer Affairs,
Food and Public Distribution
Government of India

भारतीय मानक ब्यूरो
उपभोक्ता मामले, खाद्य और
सार्वजनिक वितरण मंत्रालय
भारत सरकार

NORTHERN CENTRAL EASTERN WESTERN SOUTHERN

India

BIS Locations



-  **Headquarter**
-  **5** Regional Offices
-  **38** Branch Offices
-  **8** Laboratories
-  **Training Institute (NITS)**





ABOUT BIS

Bureau of Indian Standards (BIS), the National Standards Body (NSB) of India was established under the *BIS Act, 1986* and came into existence on 1 April 1987 assuming the functions of the erstwhile Indian Standards Institution (ISI). The ISI was established on 6 January 1947. *The BIS Act, 2016* came into force on 12 October 2017 superseding *BIS Act 1986*. *The BIS Act, 2016* provides for the establishment of a national standards body for the harmonious development of the activities of standardization, conformity assessment and quality assurance of goods, articles, processes, systems and services and for matters connected therewith or incidental thereto.

BIS through its core activities of standardization and conformity assessment, has been benefiting the national economy by providing safe, reliable and quality goods; minimizing health hazards to consumers; protecting the environment; controlling over proliferation of varieties; promoting exports and imports substitutes, etc. The standardization and conformity assessment schemes of BIS apart from benefitting the consumers and industry also support various public policies especially in areas of product safety, consumer protection, food safety, environment protection, building and infrastructure development, etc.

BIS also represents India in international standards bodies like International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) and participates actively in the international standardization work undertaken by these bodies. BIS presents the national viewpoints on new areas taken up for international standardization and on various draft international standards during the process of development of these standards so that the country's interest is protected and reflected in these standards. This also enables the BIS technical committees to consider adoption of the international standards as Indian Standards, with or without modifications, in order to enable our products and services to integrate with global trade and commerce.

What are Standards?

Standard is a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Importance of Standardization

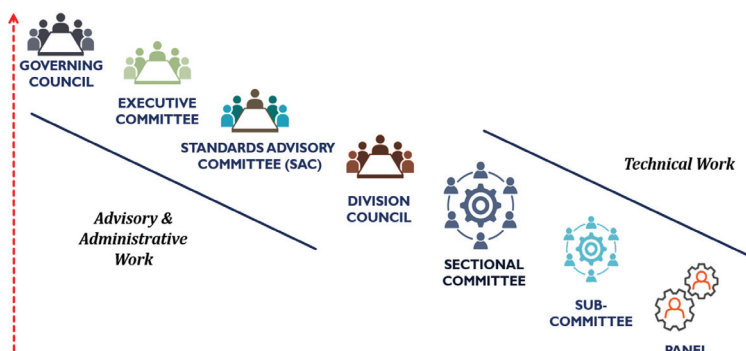
Standardization is the process of developing technical standards through consensus of different parties. This standardization aims to address one or all of compatibility, interchangeability, variety control, safety, environment protection, product protection and fitness for purpose. Standards provide numerable benefits to the technologists, producers, consumers and traders besides defining purpose for each of these entities.

Standards can be formulated at various levels ranging from an individual through National (IS) to International level (ISO). Also, depending on the subject in hand, standards can be made on various aspects such as terminology, specification, sampling, testing, code of good practice, systems and services.

STANDARDIZATION ACTIVITY OF BIS

Standardization Structure

There are 16 Technical Departments formulating standards in various subject areas. Corresponding to these departments, 16 division councils exist. Each division council has several sectional committees working under it. The standards cover important segments of economy and help the industry in upgrading the quality of their goods and services.

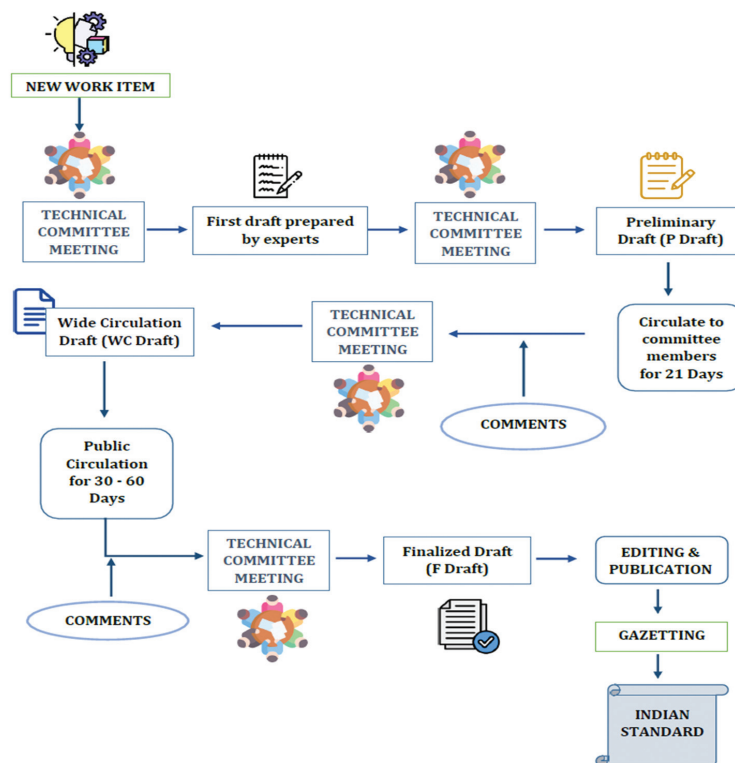
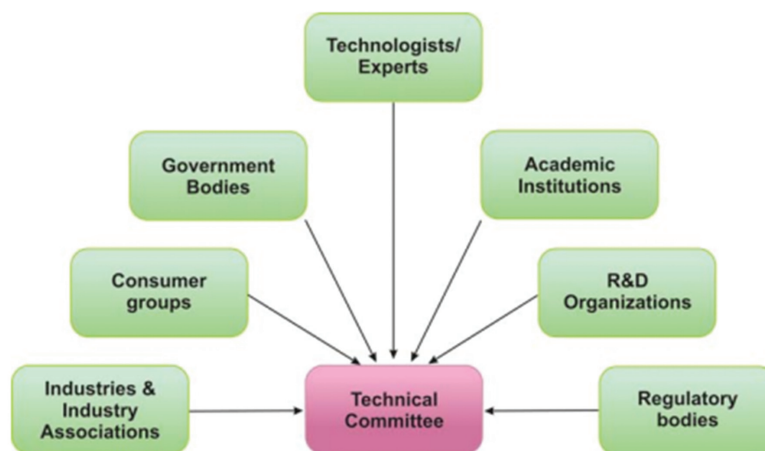


Ayush Division Council (AYDC)	Chemical Division Council (CHDC)	Civil Engineering Division Council (CEDC)	Electro-Technical Division Council (ETDC)
Electronics & Telecommunication Division Council (LITDC)	Food and Agriculture Division Council (FADC)	Mechanical Engineering Division Council (MEDC)	Management and Systems Division Council (MSDC)
Metallurgical Engineering Division Council (MTDC)	Medical Equipment & Hospital Planning Division Council (MHDC)	Petroleum, Coal & Related Products Division Council (PCDC)	Production and General Engineering Division Council (PGDC)
Transport Engineering Division Council (TEDC)	Textile Division Council (TXDC)	Water Resources Division Council (WRDC)	Service Sector Division Council (SSDC)

Standards Formulation Process

The Indian Standards are developed by technical committees that are representative of various stakeholders having interest in the relevant subject of standardization under the scope of such committees through a process of consultation so that views of all are given due consideration and a consensus is evolved in formulating a standard. The stakeholders involved in national standardization can broadly be categorized as industry, consumers/ users, technologists (R&D and scientific institutions, academia, individual subject experts, etc) and government departments/regulators.

The process of standards development of BIS is aligned with accepted international best practices that are based on the core principles of openness, transparency, impartiality and consensus. The process begins with the identification of the standardization needs of the given sector or subject following which the development of the standard is taken up and planned by the relevant technical committee. Apart from consultation within the technical committees, draft standards are also open for public views/comments.



Standards Development Process Flow



Indian Standards On Chemical Hazards

SCOPE OF CHEMICAL DIVISION COUNCIL

Standardization in the fields of

- a) Chemicals and Chemical products including Photographic materials, Electroplating chemicals, Paints and related products, Glass, Ceramicwares, Soaps and Other Surface Active Agents, Lac and Lac Products, Industrial Gases, Explosives and Pyrotechnics, Water Quality for industrial purposes, Thermal Insulation, and Nuclear Materials; including nano-materials and standards for synthetic nano materials.
- b) Paper, Stationery items, Leather, Leather Products, Footwear and Brushware.
- c) Occupational Health, Safety, Environmental Management, Environment Protection, Waste Management, aspects of sustainability relevant to environment, and Chemical Hazards.

List of Sectional Committees under Chemical Division

SL. NO.	COMMITTEE NO.	COMMITTEE NAME
1.	CHD 1	Inorganic Chemicals
2.	CHD 5	Electroplating Chemicals And Photographic Materials
3.	CHD 6	Industrial Gases
4.	CHD 7	Chemical Hazards
5.	CHD 8	Occupational Safety & Health
6.	CHD 9	Ceramicware
7.	CHD 10	Glass, Glassware And Laboratoryware
8.	CHD 13	Water Quality For Industrial Puproses
9.	CHD 14	Printing Inks, Stationery And Allied Products
10.	CHD 15	Paper And Its Products
11.	CHD 16	Paper Based Packaging
12.	CHD 17	Leather, Tanning Materials And Allied Products
13.	CHD 19	Footwear
14.	CHD 20	Paints, Varnishes And Related Proudcts
15.	CHD 21	Raw Materials For Paints, Varnishes And Related Products
16.	CHD 23	Brushware, Polishes, Lac & Lac Products
17.	CHD 25	Soaps And Other Surface Active Agents
18.	CHD 26	Explosives And Pyrotechnics
19.	CHD 27	Thermal Insulation
20.	CHD 30	Nuclear Materials For Peaceful Application
21.	CHD 32	Environment Protection
22.	CHD 33	Solid Waste Management
23.	CHD 34	Environmental Management
24.	CHD 35	Air Quality
25.	CHD 36	Water Quality



SCOPE OF CHEMICAL HAZARDS SECTIONAL COMMITTEE, CHD 7

- To formulate Indian Standard for i) Terminology, methods of sampling and test, codes of practices and guidelines relating to chemical hazards and Occupational Health and Safety related to Chemicals, ii) Classification of hazardous chemicals and chemical hazards; iii) Code of safety for operational hazards in Chemical industries and Chemical laboratories etc; iv) Safety data sheets and cards for hazardous chemicals
- Co-ordination of work with ISO/TC 336 Laboratory Design

LIST OF STANDARDS PUBLISHED BY CHEMICAL HAZARDS SECTIONAL COMMITTEE, CHD 7

To date, a total of 76 standards have been developed by **Chemical Hazards Sectional Committee, CHD 7 of BIS.**

- Some of the category wise standards are listed below.
- The complete list of published standards can be accessed at https://www.services.bis.gov.in:8071/php/BIS_2.0/bisconnect/pow_details

Sl No.	IS No.	Title
1.	IS 1446 : 2002 Reaffirmed In : 2021	Classification of dangerous goods Second Revision
2.	IS 4155 : 1966 Reaffirmed In : 2018	Glossary of terms relating to chemical and radiation hazards and hazardous chemicals
3.	IS 4209 : 2013 Reaffirmed In : 2018	Chemical laboratories - Code of safety Second Revision
4.	IS 4262 : 2002 Reaffirmed In : 2021	Sulphuric acid - Code of safety First Revision
5.	IS 4263 : 1967 Reaffirmed In : 2018	Code of safety for chlorine
6.	IS 4264 : 1967 Reaffirmed In : 2018	Code of safety for caustic soda
7.	IS 4312 : 1967 Reaffirmed In : 2021	Code of safety for lead and its compounds
8.	IS 4544 : 2000 Reaffirmed In : 2017	Ammonia - Code of safety First Revision
9.	IS 4560 : 1968 Reaffirmed In : 2018	Code of safety for nitric acid
10.	IS 4644 : 1968 Reaffirmed In : 2018	Code of safety for benzene toluene and xylene
11.	IS 4906 : 2017	Radiochemical laboratory - Code of safety First Revision
12.	IS 5184 : 1969 Reaffirmed In : 2021	Code of safety for hydrofluoric acid

13.	IS 5208 : 1969 Reaffirmed In : 2018	Code of safety for acetic acid
14.	IS 5302 : 1969 Reaffirmed In : 2021	Code of safety for acetic anhydride
15.	IS 5311 : 1969 Reaffirmed In : 2021	Code of safety for carbon tetrachloride
16.	IS 5685 : 1970 Reaffirmed In : 2021	Code of safety for carbon disulphide Carbon Bisulphide
17.	IS 5931 : 1970 Reaffirmed In : 2021	Code of safety for handling cryogenic liquids
18.	IS 6156 : 1971 Reaffirmed In : 2021	Code of safety for chlorosulphonic acid
19.	IS 6164 : 1971 Reaffirmed In : 2021	Code of safety for hydrochloric acid
20.	IS 6269 : 1971 Reaffirmed In : 2021	Code of safety for ethylene oxide
21.	IS 6270 : 1971 Reaffirmed In : 2018	Code of safety for phenol
22.	IS 6818 : 1973 Reaffirmed In : 2021	Code of safety for phosphoric acid
23.	IS 6819 : 1973 Reaffirmed In : 2021	Code of safety for calcium carbide
24.	IS 6953 : 1973 Reaffirmed In : 2017	Code of safety for bromine
25.	IS 6954 : 1973 Reaffirmed In : 2021	Code of safety for caustic potash
26.	IS 7415 : 1974 Reaffirmed In : 2018	Code of safety for aniline
27.	IS 7420 : 1974 Reaffirmed In : 2021	Code of safety for phthalic anhydride
28.	IS 7444 : 1974 Reaffirmed In : 2018	Code of safety for methanol
29.	IS 7445 : 1974 Reaffirmed In : 2021	Code of safety for acetone
30.	IS 7812 : 1975 Reaffirmed In : 2021	Code of safety for mercury
31.	IS 8185 : 1976 Reaffirmed In : 2021	Code of safety for mercury
32.	IS 8388 : 1977 Reaffirmed In : 2018	Code of safety for nitrobenzene

33.	IS 9052 : 1978 Reaffirmed In : 2021	Code of safety for aluminium chloride anhydrous
34.	IS 9053 : 1978 Reaffirmed In : 2021	Code of safety for m – Dinitrobenzene
35.	IS 9277 : 1979 Reaffirmed In : 2021	Code of safety for monochlorobenzene
36.	IS 9278 : 1979 Reaffirmed In : 2021	Code of safety for zinc phosphide
37.	IS 9279 : 1979 Reaffirmed In : 2021	Code of safety for aluminium phosphide
38.	IS 9744 : 1981 Reaffirmed In : 2021	Code of safety for thionyl chloride
39.	IS 9785 : 1981 Reaffirmed In : 2021	Code of safety for aluminium alkyls
40.	IS 9786 : 1981 Reaffirmed In : 2018	Code of safety for vinyl chloride vcm
41.	IS 9787 : 1981 Reaffirmed In : 2021	Code of safety for phosphoryl chloride
42.	IS 10870 : 1984 Reaffirmed In : 2021	Code of safety for hexane
43.	IS 10871 : 1984 Reaffirmed In : 2021	Code of safety for hydrazine and hydrazine hydrate
44.	IS 10872 : 1984 Reaffirmed In : 2021	Code of safety for malathion
45.	IS 10920 : 1984 Reaffirmed In : 2021	Code of safety for phosphorus trichloride
46.	IS 11141 : 1984 Reaffirmed In : 2021	Code of safety for acrylonitrile
47.	IS 12033 : 1986 Reaffirmed In : 2021	Code of safety for dinitrotolueneDnt
48.	IS 12034 : 1986 Reaffirmed In : 2021	Code of safety for methyl bromide
49.	IS 12035 : 1986 Reaffirmed In : 2021	Code of safety in microbiological laboratories
50.	IS 12141 : 1987 Reaffirmed In : 2021	Code of safety for methyl ethyl ketone
51.	IS 12142 : 1987 Reaffirmed In : 2021	Code of safety for 1 1 1 - Trichloro ethane
52.	IS 12143 : 1987 Reaffirmed In : 2021	Code of safety for tetrachloroethane



53.	IS 13440 : 1992 Reaffirmed In : 2018	Methyl chloride - Code of safety
54.	IS 13441 : 1992 Reaffirmed In : 2018	Ethyl ether - Code of safety
55.	IS 13442 : 1992 Reaffirmed In : 2018	Trichloro ethylene - Code of safety
56.	IS 13447 : 1992 Reaffirmed In : 2018	P - Nitro aniline - Code of safety
57.	IS 13910 : 1993 Reaffirmed In : 2018	Sulphur dioxide - Code of safety
58.	IS 13911 : 1993 Reaffirmed In : 2018	Sulphur - code of safety
59.	IS 13914 : 1993 Reaffirmed In : 2018	Perchlorates of ammonium potassium and sodium - Code of safety
60.	IS 14165 : 1995 Reaffirmed In : 2018	Handling carcinogenic substances - Code of safety
61.	IS 14200 : 1994 Reaffirmed In : 2017	Hydrogen peroxide - Code of safety
62.	IS 14518 : 1998 Reaffirmed In : 2021	Acetaldehyde - Code of safety
63.	IS 14572 : 1998 Reaffirmed In : 2017	Chloroform - Code of safety
64.	IS 14631 : 1999 Reaffirmed In : 2021	Styrene - Code of safety
65.	IS 14814 : 2000 Reaffirmed In : 2017	Acetylene - Code of safety
66.	IS 14983 : 2002 Reaffirmed In : 2021	Phosphorus White Or Yellow - Code of safety
67.	IS 14984 : 2001 Reaffirmed In : 2018	1 3 - Butadiene - Code of safety
68.	IS 14985 : 2001 Reaffirmed In : 2018	Methyl acrylate acrylate - Code ics 71 080 70 and ethyl of safety
69.	IS 15200 : 2002 Reaffirmed In : 2021	Hydrogen sulphide - Code of safety
70.	IS 15201 : 2002 Reaffirmed In : 2021	Hydrogen - Code of safety
71.	IS 15465 : 2015 ISO 10156 : 2010 Reaffirmed In : 2021	Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets First Revision
72.	IS 15548 : 2005 Reaffirmed In : 2017	Hydrofluorocarbon HFC - 134a - Code of safety



73.	IS 15656 : 2006 Reaffirmed In : 2018	Hazard identification and risk analysis - Code of practice
74.	IS 15738 : 2007 Reaffirmed In : 2018	Stable bleaching powder - Code of safety

SCOPE OF OCCUPATIONAL SAFETY AND HEALTH SECTIONAL COMMITTEE, CHD 8

- To formulate Indian Standard for i) Terminology relating to Occupational Health and Safety ii) Specifications and code of practice for testing of safety equipment iii) Code of safety for operational hazards in industries other than chemical industries iv) Occupational health and safety management system, procedure and practices
- Co-ordination of work with ISO/TC 94/SC 4 (P): Personal equipment for protection against falls ISO/TC 94/SC 6 (P): Eye and face protection ISO/TC94/SC 15 (P): Respiratory protective devices ISO/TC 283 (P): Occupational Health and Safety Management Systems ISO/TC 283 (P): Occupational Health and Safety Management Systems

LIST OF STANDARDS PUBLISHED BY OCCUPATIONAL SAFETY AND HEALTH SECTIONAL COMMITTEE, CHD 8

To date, a total of 68 standards have been developed by **Occupational Safety and Health Sectional Committee, CHD 8 of BIS.**

- Some of the category wise standards are listed below.
- The complete list of published standards can be accessed at https://www.services.bis.gov.in:8071/php/BIS_2.0/bisconnect/pow_details.

Sl. No.	IS No.	TITLE
1	IS 3521 (Part 1) : 2021 ISO 10333-1	Personal Fall Arrest Systems Specification Part 1 Full Body Harness Fourth Revision
2	IS 3521 (Part 2) : 2021	Personal Fall Arrest Systems Specification Part 2 Lanyards and Energy Absorbers
3	IS 3521 (Part 3) : 2021	Personal Fall Arrest Systems Specification Part 3 Self-retracting lifelines
4	IS 3521 (Part 4) : 2021 ISO 10333-4 ISO 10333-4	Personal Fall Arrest Systems Specification Part 4 Vertical rails and vertical lifelines incorporating a sliding-type fall arrester
5	IS 3521 (Part 5) : 2021 ISO 10333-5 ISO 10333-5	Personal Fall Arrest Systems Specification Part 5 Connectors with self-closing and self-locking gates
6	IS 3521 (Part 6) : 2021 ISO 10333-6 ISO 10333-6	Personal Fall Arrest Systems - Part 6 System performance tests

7	IS 3521 (Part 7) : 2021 ISO 14567 : 1999 ISO 14567 : 1999	Personal Fall Arrest Systems Specification Part 7 Single point anchor devices
8	IS 3521 (Part 8) : 2021	Personal Fall Arrest Systems Specification Part 8 Flexible horizontal lifeline systems
9	IS 3521 (Part 9) : 2021	Personal Fall Arrest Systems Specification Part 9 Descending devices
10	IS 3786 : 2022	Method for computation of frequency and severity rates for industrial injuries and classification of industrial accidents
11	IS 3786 : 1983	Method for computation of frequency and severity rates for industrial injuries and classification of industrial accidents First Revision
12	IS 5983 : 1980 ISO 4849 : 1981 ISO 4850 : 1979 ISO 4851 : 1979 ISO 4852 : 1978	Specification for eye - Protectors First Revision
13	IS 7524 (Part 1) : 2021 ISO 18526-1 : 2020 ISO 18526-1 : 2020	Eye and Face Protection Test Methods Part 1 Geometrical Optical Properties Second Revision
14	IS 7524 (Part 2) : 2021 ISO 18526-2 : 2020 ISO 18526-2 : 2020	Eye and Face Protection Test Methods Part 2 Physical Optical Properties Second Revision
15	IS 7524 (Part 3) : 2021 ISO 18526-3 : 2020 ISO 18526-3 : 2020	Eye and face protection Test methods Part 3 Physical and Mechanical Properties
16	IS 7524 (Part 4) : 2021 ISO 18526-4 : 2020 ISO 18526-4 : 2020	Eye and face protection Test methods Part 4 Headforms
17	IS 8091 : 2018	Industrial plant layout - Code of safe practice Second Revision
18	IS 8095 : 1976	Specification for accident prevention tags
19	IS 8218 (Part 1) : 1976	Safety code for plant railways Part 1 layout
20	IS 8218 (Part 2) : 1982	Safety code for plant railways Part 2 locomotives wagons and their movement
21	IS 8347 : 2008 ISO 16972 : 2010 ISO/TS 16973 : 2016	Respiratory protective devices - Definitions classification and nomenclature of components First Revision
22	IS 8519 : 1977	Guide for selection of industrial safety equipment for body protection
23	IS 8520 : 1977	Guide for selection of industrial safety equipment for eye face and ear protection
24	IS 8521 (Part 1) : 1977 ISO 16321-1 ISO 16321-1	Specification for industrial safety face shields Part 1 with plastics visor

25	IS 8521 (Part 1) : 2022 ISO 16321-1 ISO 16321-1	Eye and Face Protection for Occupational Use Part 1 General Requirements Second Revision
26	IS 8521 (Part 2) : 2022 ISO 16321-3 ISO 16321-3	Eye and Face Protection for Occupational Use Part 2 Additional Requirements for Mesh Protectors
27	IS 8807 : 1978	Guide for selection of industrial safety equipment for protection of arms and hands
28	IS 8940 : 1978	Code of practice for maintenance and care of industrial safety equipment for eye and face protection
29	IS 9167 : 1979	Specification for ear protectors
30	IS 9457 : 2005	Safety colours and safety signs - Code of practice First Revision
31	IS 9473 : 2002 ISO 3864-1 : 2002	Respiratory protective devices - Filtering half masks to protect against particles - Specification First Revision
32	IS 9623 : 2008	Selection use and maintenance of respiratory protective devices - Code of practice First Revision
33	IS 9679 : 1980	Code of practice for work environment monitoring Airborne Contaminants
34	IS 9937 : 1981	Specification for portable methanometer Electrical Type
35	IS 10224 : 1982 ISO 6385 : 1981	Ergonomic principles in the design of work systems
36	IS 10245 (Part 1) : 1996	Breathing apparatus Part 1 closed circuit breathing apparatus Compressed Oxygen Cylinder - Specification First Revision
37	IS 10245 (Part 2) : 1994	Respiratory protective devices - Specification Part 2 open circuit breathing apparatus First Revision
38	IS 10245 (Part 3) : 1999	Breathing apparatus Part 3 fresh air hose and compressed air line breathing apparatus - Specification First Revision
39	IS 10245 (Part 4) : 1982	Specification for breathing apparatus Part 4 escape breathing apparatus Short Duration Self - Contained Type
40	IS 10592 : 2018	Industrial emergency showers eye and face fountains and combination units - Specification First Revision
41	IS 10667 : 1983	Guide for selection of industrial safety equipment for protection of foot and leg
42	IS 13293 : 1992	Gas detector tubes - general requirements and methods of test
43	IS 13366 : 1992	Resuscitators intended for use with humans - Specification
44	IS 14138 (Part 1) : 1994 ISO 17420-3 : 2012 ISO/DIS 17420-4	Respiratory protective devices Threads for facepieces - Specification Part 1 standard thread connection
45	IS 14138 (Part 2) : 1994 ISO 17420-3 : 2012 ISO/DIS 17420-4	Respiratory protective devices Threads for facepieces Part 2 centre thread connection



46	IS 14166 : 1994	Respiratory protective devices full - Face masks - Specification
47	IS 14170 : 1994	Respiratory protective devices mouthpiece assemblies - Specification
48	IS 14489 : 2018	Occupational health and safety audit - Code of practice First Revision
49	IS 14746 : 1999	Respiratory protective devices - Half masks and quarter masks - Specification
50	IS 15322 : 2003 ISO/DIS 17420-2 ISO/CD 17420-5 ISO/CD 17420-6 ISO/CD 17420-7	Particle filters used in respiratory protective equipment - Specification
51	IS 15323 : 2003 ISO/DIS 17420-2 ISO/CD 17420-5 ISO/CD 17420-6 ISO/CD 17420-7	Gas filters and combined filters used in respiratory protective equipment - Specification
52	IS 15793 : 2007	Managing environment occupational health and safety legal compliance - requirements of good practices
53	IS 15803 : 2008	Respiratory protective devices - Self contained closed circuit breathing apparatus chemical oxygen KO ₂ type self generating self rescuers - Specification
54	IS 16508 : 2017	Swimming pool for public - Code of safety
55	IS 17274 (Part 1) : 2019 16900-1 :2014 16900-1 :2014	Respiratory Protective Devices Methods of Test and Test Equipment Part 1 Determination of Inward Leakage
56	IS 17274 (Part 2) : 2019 16900-2: 2017 16900-2: 2017	Respiratory Protective Devices Methods of Test and Test Equipment Part 2 Determination of Breathing Resistance
57	IS 17274 (Part 3) : 2019 16900-3:2012 16900-3:2012	Respiratory Protective Devices Methods of Test and Test Equipment Part 3 Determination of Particle Filter Penetration
58	IS 17274 (Part 5) : 2019 16900-5 :2016 16900-5 :2016	Respiratory Protective Devices Methods of test and test equipment Part 5 Breathing machine metabolic simulator RPD head forms and torso tools and verification tools
59	IS 17274 (Part 6) : 2019 16900-6:2015 16900-6:2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 6 Mechanical Resistance Strength of Components and Connections
60	IS 17274 (Part 7) : 2019 16900-7:2015 16900-7:2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 7 Practical Performance Test Methods
61	IS 17274 (Part 8) : 2019 16900-8 :2015 16900-8 :2015RPD	Respiratory Protective Devices Methods of Test and Test Equipment Part 8 Measurement of RPD Air Flow Rates of Assisted Filtering

62	IS 17274 (Part 9) : 2019 16900-9 : 2015 16900-9 : 2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 9 Determination of Carbon Dioxide Content of the Inhaled Gas
63	IS 17274 (Part 10) : 2019 16900-10 : 2015 16900-10 : 2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 10 Resistance to Ignition Flame Radiant Heat and Heat
64	IS 17274 (Part 11) : 2019 16900-11 : 2013 16900-11 : 2013	Respiratory Protective Devices Methods of Test and Test Equipment Part 11 Determination of Field of Vision
65	IS 17274 (Part 12) : 2019 16900-12 : 2016 16900-12 : 2016	Respiratory Protective Devices Methods of Test and test Equipment Part 12 Determination of Volume-Averaged Work of Breathing and Peak Respiratory Pressures
66	IS 17274 (Part 13) : 2019 16900-13 : 2015 16900-13 : 2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 13 RPD Using Regenerated Breathable Gas and Special Application Mining Escape RPD Consolidated Test for Gas Concentration Temperature Humidity Work of Breathing Breathing Resistance Elastance and Duration
67	IS 18001 : 2007	Occupational Health and Safety Management Systems - Requirements with Guidance for Use
68	IS/ISO 45001 : 2018 ISO 45001: 2018	Occupational Health and Safety Management Systems Requirements with Guidance for Use Second Revision

What is hazards and types of Hazards?

- **HAZARDS** include sources with the potential to cause harm and hazardous situations, or circumstances with the potential threat to life, health, property or environment.
- **INDUSTRIAL HAZARD** may be defined as any condition produced by the industries that may cause injury or death to the personnel or loss of product and property.
- **Different types of Hazards**
 - **Physical Hazards**- Physical hazards are substances or activities that threaten physical safety. They are the most common and are present in most workplaces at one time or another. These include unsafe conditions that can cause injury, illness and death.
 - **Chemical Hazards**- Chemical Hazards refers to the risk on exposure to hazardous chemical.
 - **Biological Hazards** -Biological hazards include dust and pathogens such as bacteria, viruses, fungi, and other living organisms that can cause acute and chronic infections by entering the body either directly or through breaks in the skin.

Types of Chemical Hazards in the Workplace

- **Asphyxiants**, a substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death. Example Carbon monoxide and cyanide.



- **Corrosives**, Chemicals which readily tend to attack materials in contact. Corrosives are materials that can attack and chemically destroy exposed body tissues. However, corrosive chemicals also have the potential to produce systemic chemical exposure away from the point of contact when mixed with other substances.
- **Irritants**, are material that can cause harm to the eyes, skin, or respiratory tract of a person. On exposure may lead to redness, rashes, inflammation, coughing, or hemorrhaging. Irritants are mostly short-term severe illnesses but can also have long-lasting side effects in some people. Irritant Causing Chemical Examples: nickel chloride and chromic acid.
- **Sensitizers**, a chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical. Overexposure to these chemical can lead to as asthma and contact dermatitis.
- **Carcinogens**, are cancer-causing chemical substances, and exposure to small amount of such a chemical can have severe impact on human health. The impact of these chemical substances will appear many years after the exposure. Chemical Carcinogen Examples: Benzene, cadmium, formaldehyde, and vinyl chloride.
- **Mutagens**, is a physical or chemical agent that permanently changes genetic material, usually DNA, in an organism and thus increases the frequency of mutations above the natural background level. As many mutations can cause cancer, such mutagens are therefore carcinogens. Examples: Benzene, ionizing radiation, and hydrogen peroxide.
- **Teratogens**, are the substances that on exposure can disrupt the physical and functional development of a human embryo causing birth defects and even the unhealthy advancement of pregnancy. Chemical Teratogen Examples: Thalidomide, ionizing radiation, and organic mercury compounds.
- **Reactive**, are the chemical substances which when combined with other chemical or substances such as air, water can cause explosion. Reactive Chemical Examples: Nitric acid, benzoyl peroxide, and silane.
- **Flammable**, chemical substances which burn or ignite when exposed to oxygen. Flammable Chemical Examples: Methanol, acetone, propane, and butane.

Route of Entry

- The ways by which the chemicals are able to enter the body are called “routes of entry.”
- To prevent the exposure of hazardous chemical better understanding of these routes is necessary.
- The three main “Routes of Entry” are:
- Absorption - Occurs when the hazardous chemicals come in contact of exposed parts and get absorbed in the body. To prevent absorption, wear proper protective equipment: Chemical gloves, Aprons, and Coveralls.
- Inhalation - of toxic vapors, mists, gases, or dusts can produce poisoning by absorption through the mucous membrane of the mouth, throat, and lungs and can seriously damage these tissues by local action. In order to prevent inhaling hazardous chemicals proper respiratory protection should be used.
- Ingestion - Ingestion of hazardous chemical occur directly when hazardous chemicals are eaten or swallowed and indirectly if while handling of chemicals proper precautions are not taken.



How Can A Chemical Hazard Affect Your Health?

Skin Absorption

- Itching
- Redness
- Burns
- Blisters
- Rash/Hives

Ingestion

- Abdominal Pain
- Nausea
- Vomiting
- Diarrhea
- A warm sensation in the stomach (halogenated hydrocarbons)
- Dark-colored (black water) urine (arsenic)
- Dehydration

Inhalation

- Drowsiness
- Dizziness/Vertigo
- Headache
- Confusion/Lethargy
- Clear drainage from nose
- Cough/Dry/Scratching/Burning Throat
- Blurred vision
- Shortness of breath
- Rapid breathing (tachypnea)
- Rapid heart rate (tachycardia)

Eye Contact

- Redness of the eyes
- Burning sensation in eyes
- Constant tear production
- Mucous discharge from tear ducts
- Blurred vision / blindness (partial or complete)



Recent accidents in Chemical Industries

S No.	Date	Industry	Accident Details	Effects
1.	16.12.2021	Gujarat Fluoro Chemicals	Explosion	Around 15 workers were injured in the explosion and the subsequent fire. 3 died
2.	08.06.2021	SVS Aqua Technologies	Fire during packaging	18 dead in fire
3.	13.04.2021	Speciality Chemicals, Tarapur MIDC	Explosion	2 workers were killed and 3 other injured during explosion
4.	07.05.2020	Polymer Manufacturing unit, Vizag	Styrene Gas leak	Styrene vapor got released from the styrene storage tank causing 12 deaths, around 1000 hospitalized, and nearly 12000 evacuated. An estimated 800 tons gas leaked into atmosphere

DETAILS OF STANDARDS

1. IS 7445: 2022 ACETONE – CODE OF SAFETY

- Acetone is highly flammable and at temperature greater than its flashpoint air-acetone mixture can explode and catch fire. Static discharge may also ignite acetone. Accident produces social and economic loss, and impairs individual or group activity.

SCOPE

This code describes the properties of acetone and nature of hazards associated with it. The standard also prescribes safety measures for controlling hazards and essential information on symptoms of poisoning, first-aid, medical treatment, storage, handling, labelling and employee safety. This standard is intended to guide the users in the recognition of these hazards and in establishing safe handling procedures.

PHYSICAL, CHEMICAL FIRE AND EXPLOSION HAZARD

- **Physical properties** such as –state (liquid), odour (pungent), solubility(soluble in benzene, and diethyl ether)etc.
- **Chemical Properties** – react violently with bases, oxidising agent and corrodes carbon steel, and 13 Cr steel.
- **Fire and Explosion Hazard**
- Upper explosive limit- 12.8 vol percent
- Lower Explosion limit- 2.6 vol percent



HEALTH HAZARD AND TOXICITY

- **Routes of Entry**
- **Skin**
 - Repeated dermal exposure to liquid acetone can cause defatting and drying of the skin, and brittle nails. Chemical burns may develop after prolonged exposure. Prolonged contact with skin may cause redness, itching, irritation and eczema/chapping, and cracking of the skin.
- **Eyes**
- Acetone and its vapours are mildly irritating to the eyes and mucous membranes. Corneal erosions are a rare effect after high concentration exposure. It is characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury.
- **Ingestion**
 - In an unlikely event if acetone is ingested it could cause systemic toxicity with symptoms like headache, lethargy, slurred speech, lack of coordination. Higher amount of ingestion can be life threatening. Irritating, may cause nausea, stomach pain and vomiting. Inhalation of vapours may cause nausea, vomiting, headache, excitement, faintness, fatigue, and bronchial irritation may result from inhalation exposure. With high concentration exposures, systemic toxicity can occur similar to that seen with ingestion. May cause irritation to the mucous membranes and upper respiratory tract. In high concentrations, vapors and aerosol mists have a narcotic effect and may cause headache, fatigue, dizziness and nausea.
- **Long term effects**
 - Systemic toxicity most commonly occurs after ingestion or prolonged or high concentration inhalation, rarely after extensive dermal exposure. Repeated or prolonged exposure to the substance can produce target organs damage.
- TLV – 2400 mg/m³, STEL – 1780 mg/m³

STORAGE AND HANDLING

- **Storage**
 - Storage of any combustible material should not be allowed in the building. Acetone storage tanks should be grounded to prevent danger by lightening.
 - Storage tanks may be constructed of stainless steel. The storage tanks should be placed in retaining basins, also to be constructed of concrete or welded steel. The basins should be adequate to retain the full contents of the tank or tanks. Water lines should be provided to allow instant flooding of basin.
 - Sealed tanks should be equipped with frangible discs or safety valves set to release at a predetermined pressure. End of pressure relief line should go out through flame arrester to a safe area. Vent line of tank should go to a cooled condenser to condense the vapours and return it back to tank. An ample safety factor should be allowed to protect the tank itself. Vent of condenser should go to safe area through flame arrester. Firefighting facilities applicable to



the type of tank protected. This can include fire loops with hydrants and monitors in the storage area, foam systems for the individual tanks, and deluge spray systems to keep the exposed surfaces of tanks cool in case of fire in an adjacent tank.

- Storage and handling facilities shall be sited in well ventilated areas to prevent the accumulation of pockets of acetone vapour.
- Pipelines shall be supported by steel stanchions or concrete sleepers. Wood shall not be used. Pipelines shall have adequate electrical continuity and shall be earthed. Storage of any combustible not allowed in premises
- Areas where acetone is handled shall be posted with 'NO SMOKING' and other appropriate warning signs, as required by the operations.
- If leaks or spills occur, only properly trained personnel shall remain in the area. Leaking containers shall be removed to an isolated, well-ventilated area and the contents transferred to other sound containers. All spills shall be flushed away promptly with water. Excessive quantities of acetone shall not be permitted to enter drains or sewers where there is danger of vapours becoming ignited.
- All empty tanks or other containers which have contained acetone, except when they are opened for the purpose of cleaning them and rendering them free of acetone vapour, shall be kept securely closed unless they have been thoroughly cleaned.
- Protection against electrostatic charges which can cause ignition. This may include the bonding and grounding of the tank, piping, and other ancillary equipment and the use of bottom or dip-pipe loading to minimize material splashing in the tank.
- As Acetone is a solvent, the selection of compatible material must prevent the material itself being dissolved. Acetone is a polar solvent and must not be combined with similar materials such as PVC, natural rubber as these elastomers will inherently fail. Compatible materials include most metals, polytetrafluoroethylene (PTFE) and tetrafluoroethylene (ETFE).
- Acetone is generally pumped from storage tank using suitable pumps. Acetone can be filled in small containers by gravity ensuring containers and transfer pipes are grounded to avoid fire due to static charge.
- One storage tank equal in capacity to the largest tank in use should be kept free at all times to transfer acetone in case of emergency.
- Empty drums/containers shall be stored where they will be safe from unauthorised interference and shall be securely closed. It shall be recognized that a container which is empty with only enough of the volatile flammable liquid remaining to wet the inside, may be more dangerous from the stand point of explosion in the container than the container when filled with liquid, owing to the larger volume of explosive mixture that it contains.
- **LEAK AND SPILLAGE**
 - If leaks or spill occurs properly trained personnel shall remain in its vicinity. Leaking Containers shall be removed to an isolated and well ventilated area and content to be transferred to sound container.



- All spills shall be flushed away properly with water, excessive acetone not permitted to drain where there is danger of vapor becoming ignited.
- Disposal of container and material should as hazardous waste. Disposal of waste acetone and container shall be done as per local and state regulations.
- Waste acetone can be recovered by distillation
- **FIRE FIGHTING**
 - Use water sprays, alcohol resistant foams, dry extinguishing powder, carbon dioxide to fight fire.
 - Don't use fire jets as it would scatter the material cause secondary fires.
 - Move container from fire area if without risk. Use water from side and from safe distance to keep fire exposed containers cool.
 - All personal engaged in fire-fighting operation must use appropriate PPEs to prevent exposure.
 - Installation of safety showers, fountains for flushing eye shower.

TRAINING AND FIRST AID

- Training should be given to all new employee to maintain high degree of safety in handling procedures. Older employee should be re-instructed and trained properly.
- An annual physical examination should be conducted for each employee who is constantly exposed to acetone. He should be instructed to report any illness, or any disorder of skin that he experiences. Liver function test and complete blood count on annual basis is recommended. Liver function test and complete blood count on annual basis is recommended.
- On skin exposure - Immediate rinse the skin with water. This may be accomplished by the copious use of running water. Take off contaminated clothing

2) Is 4906: 2017 Radiochemical Laboratories- Code Of Safety

- Radiation science is a very specialized field. Radioisotopes are increasingly employed in medicines, agriculture, industry and in research laboratories.
- The characteristic radiotoxicity and difficulties of detection of these radioisotopes may have hazardous impact on life.
- For prevention of chemical accidents, in radiochemical laboratories Indian Code of Safety for Radiochemical Laboratories IS 4906:2017 may be consulted.

SCOPE

This code recommends measures that should be adopted to prevent or minimize the exposure to ionizing radiation in a radiochemical laboratory handling small amounts of radioactive materials. It describes important characteristics of radioactive materials, nature of hazards, design requirements of laboratories and other essential information for protection against radiation.



MODES OF EXPOSURE

In a workplaces, exposure to radiation is by two modes:

- a) **External Exposure** – is attributed to the sources that are external to the body. Alpha and low energy beta radiation do not cause any external hazards whereas gamma radiation and neutron are mainly external exposure hazards.
- b) **Internal Exposure** – results from irradiation by the sources inside the body. The pathways of internal exposure are: inhalation or ingestion of a radioactive material or absorption of radioactivity through skin and cuts/wounds.

Standard IS 4906: 2017 lays emphasis and provides guidance on:

- Important characteristics of radioactive material and their storage and hazardous impacts.
- Precautions to be taken in the design and layout of radiochemical laboratories.
- Prescribes the precautions to be taken while handling, storage and disposal of radioactive material.
- Includes training and safety supervisions.
- Protective measures to be taken while working includes- equipments, protective clothings, and respirators.

3) IS 4209: 2013 CHEMICAL LABORATORIES – CODE OF SAFETY

SCOPE

This standard recommends a code of safety for chemical laboratories. This standard does not cover hazards relating to radioactive substances.

STANDARD IS 4209: 2013 LAYS EMPHASIS AND PROVIDES GUIDANCE ON:

- Chemical laboratories are places equipped for conducting scientific experiments in field of test methods and manufacture of chemicals etc. and also include labs for teaching practical sciences.
- The code of safety for chemical laboratories are needed because of following:
 - i) Due to hazards inherent in the nature and handling of chemicals;
 - ii) Due to hazards from inadequacy or handling of instrumental facilities necessary in chemical laboratories, such as electricity, glassware, machinery equipment, gas, steam, water, apparatus for high/low temperature and pressure. Innumerable chemicals used as reagents and solvents are flammable/toxic/corrosive/poisonous, etc, and are harmful/irritants to body tissues.
- For prevention of chemical accidents, in chemical laboratories Indian Standard Code of Safety for Chemical Laboratories IS 4909: 2013 may be consulted.
- Factors involving safety.
- Functional design, incompatible material, disposal and safety equipments to be available in the chemical laboratories.



- General laboratory techniques.
- Measure to be taken in case of accidents, labeling of hazardous chemicals.

RULES OF CONDUCT

- Smoking is strictly prohibited in working areas other than those specified.
- Reporting to work in an intoxicated condition is strictly forbidden and punishable.
- All other activities detrimental in maintaining safety in the laboratory should be strictly prohibited.
- Work in isolation shall be avoided in a laboratory; always a second person should be within call.
- Handling or consuming food or drinks in laboratories shall be avoided.
- Good personal hygiene such as washing the hands thoroughly before handling or consuming food or drinks, having a thorough body wash or bath at the end of shift wherever insisted are essential.
- Good housekeeping is considered as the backbone of laboratory safety. Returning equipment not in use to their proper storage place, clear labelling of chemicals, keeping laboratory floor free of obstruction and other good house-keeping practices should be strictly followed.
- A periodic check of windows, store wells, fire appliances, first-aid boxes, etc, in the laboratory should be made.
- A suitable fire extinguisher should be located close to each laboratory.
- All substances should be regarded as potential sources of hazards and handled with care.
- Safety carriers should be used for transporting glass or plastic containers with a capacity of two liters or greater. Incompatible chemicals should never be transported together. They should be transported in separate carriers.
- All safety equipment shall be properly labelled and maintained in good operating condition and be regularly checked and inspected for correct operation in accordance with the manufacturer's instructions and record of such checks/inspections should be maintained.
- Allowable maximum quantities of dangerous substances, consistent with efficient operation shall be established for each laboratory and never exceeded.
- Safety information and emergency procedures should be prominently displayed. Emergency procedures should be posted in each laboratory giving telephone numbers of, a) Fire brigade; b) Ambulance; c) Supervisor/Safety coordinator; and d) Hospital.
- Spills should be cleaned immediately and thoroughly. The nature of spills should be ascertained and spills treated accordingly.
- In case of an injury, the supervisor and safety coordinator should be informed and prompt first-aid should be taken/provided.
- All accidents should be reported to the immediate supervisor. All accidents should be investigated and recorded.
- Standard operating procedure (SOP) should be available.
- All unsafe conditions and unsafe acts by fellow workers, which are likely to cause an accident, should be reported, to the supervisor.



- In case of an emergency such as a fire, explosion, etc, the supervisor should be informed or arrangement is to be made to inform the supervisor or safety coordinator or head of the department nearest available and laid down procedure is to be followed.
- All the exits are to be kept free of obstructions to facilitate quick escape in an emergency.
- Proper lift (meant for carrying materials) is to be used while carrying dry ice or liquid nitrogen. Liquid oxygen should not be used as a substitute for liquid nitrogen.
- Separate cans should be kept to deposit broken glass as otherwise the person cleaning the laboratory can sustain cuts from glass, if mixed with other wastes like paper, rubber, etc.
- Chemical wastes should be segregated category-wise and properly disposed off as per approved written procedures. Each laboratory should have a comprehensive safety manual.
- Gas cylinders should never be dragged while transporting; when kept vertical, they should be chained to avoid their fall. While storage the valve cap should be in place. Pressure regulators specific to the gas only should be used.
- In case of fire, lift should not be used.

4) IS 15656:2006 HAZARD IDENTIFICATION AND RISK ANALYSIS - CODE OF PRACTICE

SCOPE

This Code describes specific techniques to prevent human and property losses in the operation and management of process plant. The overall methodology presented in this Code allows systematic identification of hazards as well as quantification of the risks associated with the operation of process plants. Applied with due expertise and rigorous the prescribed methodology can help the user understand the relative levels of hazards and risk potential in an installation. This aids the selection and prioritization of necessary strategies for accident prevention and limiting their consequences. Therefore, the Code can be used for improving plant safety performance as well as to reduce human and property losses. Risk analysis is a process that consists of a number of sequential steps as follows:

- Hazard Identification — Identification sources of process accidents involving release of hazardous material in the atmosphere and the various ways (that is scenarios) they could occur.
- Consequence Assessment — Estimating the probable zone of impact of accidents as well as the scale and/or probability of damages with respect to human beings and plant equipment and other structures.
- Accident Frequency Assessment — Computation of the average likelihood of accidents.
- Risk Estimation — Combining accident consequence and frequency to obtain risk distribution within and beyond a process plant.

This Code describes the essential nature of each of the above sequence of steps and describes a variety of techniques for identifying hazards and the quantification of accident consequence and the frequency towards the final risk estimation.

The Quantitative Risk Analysis (QRA) is most applicable and provides meaning results when a plant is built, operated and maintained as per design intent and good engineering practices.



Standard IS 15656: 2006 lays emphasis and provides guidance on:

- Prevention of human and property losses is integral to the operation and management of chemical process plants. This may be achieved through the selection of a technology that is inherently safe. Alternatively safety of plant design and/ or operation can be audited by the application of hazard identification and risk analysis techniques, and adopting measures suggested by the analysis. The latter approach constitutes Quantitative Risk Analysis (QRA).
- This Code of practice is intended for safety professionals and engineers in the areas of chemical plant safety to upgrade safety performance of the plants and covers the methods of identifying, assessing and reducing hazards including evaluation and selection of methods for particular applications.

5) IS 17899:2023 MATERIAL SAFETY DATA SHEET

- Material Safety Data Sheet (MSDS) or simply SDS (Safety Data Sheet) is the means of communicating information about the hazardous properties of a material to the users, plant workers, people handling material in transit, the government agencies involved and general public. This is an essential component of hazard communication.
- This standard provides requirements for the format for Material Safety Data Sheet (MSDS). The possible contents that should be given under each of the 16 sections of the format are outlined. Guidelines for compilation and completion of an MSDS also have been provided.
- The 16 sections of the format are:

❖ SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

- This section shall state the identification of the product as used on the label. It is also recommended to state the supplier product code, where it accompanies the product.
- The name, address and telephone number of the supplier shall be stated. The emergency telephone number should be given. Fax number and email address may also be given.
- Recommended uses and restrictions on use of the chemical products should be stated.

A-3 SECTION 2 - HAZARDS IDENTIFICATION A-3.1 It is recommended to summarize clearly and concisely the important hazards and adverse effects of the chemical product on human health and the environment, and physical and chemical hazards, including specific hazards, where appropriate. A-3.2 If a chemical product is classified in accordance with the GHS classification, this section shall provide its hazard class and category in the GHS as well as the GHS label elements that are pictograms or symbols, signal word(s), hazard statement(s) and precautionary statement(s). Pictograms or hazard symbols may be provided as graphical production of symbols in black and white or as the name of symbol, examples, flame, skull and cross bones. It is also recommended to state other hazards which do not result in GHS classification, example, dust explosion hazard. Any adoption of the GHS classification should be stated clearly in this section (example, by describing an applicable regulation).

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❖ **SECTION 3 - COMPOSITION/INFORMATION ON INGREDIENTS**

- This section shall state whether the chemical product is a substance or a mixture.
- In the case of a substance, the systematic chemical name (example, International Union of Pure and Applied Chemistry - IUPAC name, CAS name) and the trivial common or generic name(s) shall be given.
- The Chemical Abstract Service Registry Number (CAS number) and other identifiers, wherever available, should be given.
- The systematic chemical name (example, IUPAC name, CAS name) and trivial, common or generic name and concentration range or concentration ranges of all hazardous ingredients including impurities and stabilizing additives which contribute to classification of the substance should also be indicated.
- In the case of mixtures, it is not necessary to give the full composition.
- If the ingredients which are hazardous, are present above their cut-off levels, the chemical identity and concentration or concentration ranges of all the relevant ingredients shall be given. When hazardous ingredients are identified, their systematic chemical names (example, IUPAC names, CAS names) or trivial, common or generic names and their concentration.

❖ **SECTION 4 - FIRST-AID MEASURES**

- This section shall state the first-aid measures to be taken, if necessary. It shall state which actions have to be avoided at all costs. The information should be readily understandable by the person adversely affected and/or the first-aider.
- The information shall be subdivided according to the different exposure routes, i.e. inhalation, skin contact, eye contact and ingestion.
- If specific agent is recommended as an antidote, it should be given here.
- A brief description of the anticipated acute effects, anticipated delayed effects and most important symptoms/effects should be given here. However, a detailed description of symptoms and effects should be given under section 11.
- If appropriate, advice for the protection of first-aiders and/or special notes to an attending physician may be included here.

❖ **SECTION 5 - FIRE-FIGHTING MEASURES**

- This section shall state which extinguishing media are suitable and also, if appropriate, which extinguishing media are unsuitable.
- Specific hazards arising from the chemical product (example, nature of any hazardous combustion products) should be indicated here.



- Specific extinguishing methods and any special protective equipment required should be indicated under precautions for fire-fighters.

❖ SECTION 6 - ACCIDENTAL RELEASE MEASURES

This section shall contain information on:

- i) Personal precautions, protective equipment, and emergency procedures;
- ii) Environmental precautions;
- iii) Ventilation
- iv) Methods and materials for containment and methods and materials for cleaning up (recovery, neutralization and disposal, if different from section 13). Secondary disaster prevention measures may be included.

❖ SECTION 7 - HANDLING AND STORAGE

Handling

This subsection shall describe precautions for safe handling of a chemical product. They shall include suitable technical measures such as prevention of exposure of the handler to the chemical product and prevention of fire and explosion as well as suitable precautions such as local/general ventilation and prevention of aerosol and dust. They shall also include specific handling precautions for prevention of contact with incompatible substances or mixtures.

Storage

This subsection shall describe conditions for safe storage (suitable storing conditions and unsuitable storing conditions). They shall include suitable technical measures and measures for separation from incompatible substances and mixtures.

Wherever trained personnel for handling and storage of the chemical are required, that should be indicated in this section.

❖ SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

- Permissible concentration such as occupational exposure limit value or Biological Exposure Index (BEI), wherever available, should be given. Also Emergency Response Planning Guideline (ERPG) values, wherever available, should be given.
- If appropriate, engineering controls to reduce exposure should be given. The information provided here should complement that provided under section 7.
- If possible, the permissible concentration should be dated and its source cited. Information on the recommended test method and its source should also be provided.
- The section shall also contain recommendations on appropriate personal protective equipment, such as that for: i) respiratory protection; ii) hand protection; iii) eye protection; iv) skin and body protection be indicated.
- For a chemical product that only poses a hazard under special conditions, such as large volume, high concentration, high temperature and high pressure, specific precautions for these conditions should be stated.



❖ SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

- Where applicable, this section shall provide information on:
 - i. Appearance of a chemical product, example, physical state, form and colour;
 - ii. Odour;
 - iii. pH, with indication of the concentration;
 - iv. Melting point/freezing point;
 - v. Boiling point, initial boiling point and boiling range;
 - vi. Flash point; vii. Upper/lower flammability or explosive limits;
 - vii. Vapour pressure;
 - viii. Vapour density;
 - ix. Density/relative density;
 - x. Solubility (ies);
 - xi. n-octanol/water partition coefficient; x
 - xii. Auto ignition temperature;
 - xiii. Decomposition temperature.
- Where applicable, information should be provided on:
 - i. Odour threshold;
 - ii. Evaporation rate;
 - iii. Flammability; and
 - iv. Viscosity
- Other data relevant to the safe use of the chemical product, such as radioactivity or bulk density, should also be specified. Other units may also be given, but only in addition to the SI units. If appropriate, the method used in the determination.

❖ SECTION 10 - STABILITY AND REACTIVITY

- This section shall describe the chemical stability and hazardous reactions occurring under specific conditions. This section shall contain information on:
 - i. Conditions to avoid (example, static discharge, shock or vibration);
 - ii. Incompatible materials; and
 - iii. Anticipated hazardous decomposition products.
- The original intended use and reasonably anticipated misuse should be considered.

❖ SECTION 11 - TOXICOLOGICAL INFORMATION

- This section shall contain a concise but complete and comprehensible description of the various toxicological (health) effects of the chemical product, which can arise if the user comes into contact with it.
- The description should include: i) Acute toxicity; IDLH/LD50/LC50 values ii) Skin irritation/corrosion; NOTE – Skin Corrosion is synonymous with – skin burning. iii) Eye damage/irritation; iv) Respiratory



or skin sensitization; v) Reproductive cell mutagenicity; vi) Carcinogenicity; vii) Reproductive toxicity; viii) Specific target organ toxicity – single exposure; ix) Specific target organ toxicity – repeated exposure; and x) Inhalation hazard; NOTE – inhalation hazard is synonymous with – aspiration hazard.

- The description may list: i) toxicokinetics, metabolism and distribution. (Data on in vitro mutagenicity, such as ames test, under reproductive cell mutagenicity may be given).
- If appropriate, distinction shall be made between effects due to single exposure, repeated exposure and continuous exposure. Immediate and delayed effects shall be mentioned separately, if appropriate.

❖ SECTION 12 - ECOLOGICAL INFORMATION

- This section shall contain information on possible environmental effects, behaviour, and fate, such as information on: i) Anticipated behaviour of a chemical product in environment/possible environmental impact/ecotoxicity; ii) Persistence and degradability and consequences; iii) Bioaccumulative potential; and iv) Mobility in soil.
- Additional results of data from scientific experiments, with reference to the sources of information, may be given. Any ecological limit value may be indicated here.

❖ SECTION 13 - DISPOSAL CONSIDERATIONS

- The information on recommended methods for safe and environmentally preferred disposal.
- These methods of disposal apply not only to the chemical product (waste from residues) but also to any contaminated container and contaminated packing.
- The attention of the recipient should be drawn to the possible existence of local disposal regulations.

❖ SECTION 14 - TRANSPORT INFORMATION

- This section shall contain information on codes and classifications according to international regulations for transport, differentiated by the mode of transport, such as land, sea and air.
- If applicable, information should be provided on: i) UN number; ii) UN proper shipping name; iii) UN Classification [Transport hazard class(es)]; iv) Packing group (if applicable); v) Marine pollutant (Y/N); and vi) Special precautions which a user needs to be aware of, or needs to comply with in connection with transport or conveyance either within or outside their premises.
- Any Other regulations may be added.

❖ SECTION 15 - REGULATORY INFORMATION

- This section should provide information including names of laws specifically applied to a chemical product in a region/country where the SDS is applied.
- Information on the regulation relevant to the law should be included. The information should include labelling of a chemical product, where applicable. Attention of the recipient should be drawn to the possible existence of local regulations.

❖ SECTION 16 - OTHER INFORMATION

- This section should provide any further information which may be important from a safety point of view but not specifically relevant to previous headings.



- For example, necessity of specific training and the recommended use and possible restrictions of the chemical product may be stated. Literature reference may also be listed here

6) IS 10592: 2018 INDUSTRIAL EMERGENCY SHOWERS, EYE AND FACE FOUNTAINS AND COMBINATION UNITS — SPECIFICATION

It is essential that in all areas where exposure to such corrosive or toxic chemicals is possible, adequate eye and face protection of proper type is used by the concerned persons. Such protection for eyes, face and entire body can be easily provided by emergency eyewash fountains and emergency safety showers, if they are suitably located and properly designed and maintained.

SCOPE

- This standard prescribes minimum performance requirements for emergency showers, eye and face fountains, combination units Self-contained eyewash and Personal eyewash units.

EYE/FACE WASH FOUNTAINS

- Eye/Face wash fountains are usually provided with a pair of eyewash heads and a receptacle for collection and drainage of spilled water.
- Eye/Face wash fountains shall be connected with a source of clean and cool water supply at a pressure head of approximately 196 kPa and combined flow compensation so as to regulate the flow of water at the eye/face wash heads at approximately 12 l/min for a period of 15 min
- The valve shall be capable of remaining activated until intentionally shut off. The valve shall be simple to operate and go from 'off' to 'on' in 1 s or less. The valve shall be corrosion resistant to potable water.
- Open the valve on the eye/face wash unit. Verify that it opens till 1s and stays open.
- Eye/Face wash units shall be checked periodically for the free flow of water and checked for unobstructed passages. Functioning of the pressure compensating devices shall also be checked periodically.
- Individuals shall be trained in the proper use of emergency eyewash units.

EMERGENCY SHOWERS

- The emergency safety shower should wash the entire body surface with large volumes of water in the shortest possible time. Emergency showers are generally of two designs, namely, overhead single dome type, and multiple nozzles spray type. Because of the required deluge action, water pressure head for the emergency shower shall be not less than 196 kPa (2 kgf/cm²) and the total water delivered from the shower or the spray nozzles shall be not less than 76 l/min.
- The eyewash fountains and showers shall be made from corrosion-resistant materials. This aspect shall be looked into to ensure proper maintenance and repairs.
- A multiple spray shower may be provided with 15 - 20 spray nozzles suitably located to direct flow of water from head to foot from all sides.
- The valves shall be designed in such a manner that the water flow remains 'on' without requiring the use of the operator's hands. The valve shall be capable of remaining activated until intentionally shut off. The valve shall be simple to operate and go from 'off' to 'on' in less than or equal to 1 s.



- Shower and spray nozzles shall be checked at least once a week to ensure proper functioning. They shall be activated daily to flush the line and to verify proper operation.

7) **IS 17893: 2023 WORK PERMIT SYSTEM**

Work permit means a certified procedure for allowing certain work to be carried out in a fixed place and during a given period of time. It is also a procedure authorizing entry to certain facilities. It provides a check list for a systematic method of risk assessment, warns the residual hazards in the job, and outlines the precautions to be taken while carrying out the job to achieve the stated objectives. It provides responsibility for the persons who are accountable for authorizing the work and ensuring that the workplace is safe. It establishes safe working conditions for carrying out any maintenance/repair/inspection work, and to serve as an official record of those established conditions as requirements agreed upon by the issuer and acceptor of the permit.

SCOPE

- This standard prescribes work permit for the following work areas:
 - a) Cold work permit;
 - b) Hot work permit;
 - c) Confined space/vessel entry permit;
 - d) Excavation permit;
 - e) Electrical work permit;
 - f) Work at height permit; and
 - g) Radiography
- In general, Work permit procedure is applicable to all restricted areas in the plant or unit. However, Work permit may not be applicable for the following areas/activities:
 - a) Routine welding/cutting and similar maintenance/fabrication jobs carried out inside or adjacent to any plant unit workshops and central workshops or the area demarcated/allotted by the approval of the facility in-charge;
 - b) Routine sampling for the purpose of laboratory analysis;
 - c) Canteen for cooking, preparing tea/food, etc;
 - d) Torches, furnaces, sparking equipment, etc in designated locations of laboratory;
 - e) Collection of garbage from specified safe locations in the plant area;
 - f) All cold jobs in office buildings including control room buildings. However, jobs requiring electrical isolation, work at height and excavation, etc in these areas will require work permit;
 - g) Visual inspection by maintenance or inspection personnel of rotary or static equipment in the plant;
 - h) Replacement of tube light rods inside buildings. Verbal permission from shift in-charge/area in-charge is to be obtained before starting the job. Replacement of bulbs on poles inside plant areas and on roads requires permit;
 - j) Gardening related manual jobs like grass cutting with hand cutter, branch trimming cutting, etc around office buildings, control room buildings, plant areas, non-plant areas. However for jobs requiring electrical connection like lawn movers, mechanized hacksaw machine, and



work at height like climbing on tree and excavation more than 30 cm deep will require respective work permit; and

- k) Any other routine activities authorized by the facility in-charge by a separate notification.

DETAILS OF WORK PERMITS FOR DIFFERENT WORKS

➤ Cold Work

Cold Work is an activity, which is not likely to produce sufficient heat capable of igniting flammable gases. Examples of Cold work are as follows:

- a) Erection/removal of scaffolding;
- b) Insulation of equipment/pipelines;
- c) Painting — All painting of equipment or pipelines or buildings at temperatures below 50 °C;

NOTE — Pressure spray painting requires a hot work permit.

- d) Routine instrument repairs/troubleshooting that do not involve process isolation or work on process trips;
- e) Equipment greasing and lubrication;
- f) Condition monitoring of rotary equipment;
- g) Tests to be carried out by maintenance personnel or any other external agency other than the operating personnel;
- h) Work on equipment like DCS panel, UPS, invertors;
- j) Excavation, digging, road cutting, removing soil, chipping and grading to a depth less than 30 cm deep, either using mechanical equipment or manually;
- k) Work at height-any work at or above 1.8 m above ground level, where permanent platform and guard railing are not provided;
- m) Hydro-jetting;
- n) Online sealing (only fermenting job-no drilling);
- p) Sand blasting;
- q) Use of portable electric tools and appliances in areas other than plant operating areas;
- r) Use of vacuum cleaners/other gadgets requiring power supply in areas other than plant operating areas; and
- s) All inspection and test work performed by employees other than those assigned to operate the equipment.

➤ Hot Work

Hot work is any type of work which produces heat/spark capable of igniting any flammable or combustible material. Examples of hot work are as follows:

- a) Welding, grinding, burning, soldering, brazing, blasting, gas cutting, chipping by spark-producing tools, use of open flames, tar melting, electrical arc of any kind and any other equipment which may create a source of ignition, use of hot plates;
- b) Hacksaw cutting on equipment, line or vessel of hydrocarbon services;



- c) Any equipment, line or vessel which contained any explosive, corrosive or toxic material and removed from service for cleaning, repairing, maintaining, reclaiming or discarding in and around workshop to a location where “Hot Work” is already permitted;
- d) Use of Non-flame proof electrical equipment like cameras, mobile phones, non-intrinsically safe radio pagers, etc use IS 17893 : 2023 2 of certain power driven tools like pneumatic concrete breaker, use of equipment operated by internal combustion engines, etc inside hazardous areas;
- e) On line leak sealing (if includes hot work like drilling, etc) in pipelines and equipment, hot tapping involving welding and drilling in pipelines, and pressure spray painting; and
- f) The following jobs though not qualify as hot jobs as per definition, require hot work permit:
 - 1) Work involving radioactive sources:
The isolation or restoration of a radioactive source including the use of mobile X-ray/radiography equipment.
 - 2) Work beneath or adjacent to uninsulated electrical power cables (for example, LT, HT lines) within 3.0 m radial distance.

➤ **Confined space/Vessel entry**

A confined space is defined as an area which is not designed for continuous human occupancy. It is large enough for a person to bodily enter in the area and perform the assigned work. It has got limited or restricted means for entry and exit and may or may not be enclosed.

Confined space is subjected to potential hazards, namely, accumulation of toxic or flammable gas/vapour, inert gas, oxygen deficiency (< 20 percent v/v), flooding of liquid, steam or any other hazardous substance or development of hazardous conditions.

Some of the examples of confined spaces are as follows:

- a) Tanks, columns, reactors, oil/water sewer pits, coolers, condensers, reservoirs, pipe lines, tanker trucks, skirts of column and vessels, floating roof decks, ducts, pits, tunnels, etc; and
- b) This also includes column skirts, large diameter pipelines, storage tanks, spheres, bullets, bins, silos, sumps, trenches, pits, sewers, furnaces, flare stacks, gas turbine chambers, underground service lines, work in open type vessel deeper than head level, boiler drums, surface condensers, flue ducts, Heating ventilation and air conditioning ducts, false ceilings and floors, deck of floating roof tank etc, where deficiency of oxygen or presence of toxic/flammable gases is likely and/or the access is difficult during maintenance/ inspection work.

➤ **Excavation**

For carrying out excavation of ground/soil below 30 cm, a separate permit that is excavation permit shall be issued. Annex D shall be followed to issue excavation permit.

➤ **Electrical Work**

For carrying out electrical work, positive isolation of electrical energy of power driven equipment is essential. A separate permit that is electrical work permit shall be issued for the electrical work.



➤ **Work at Height**

Work Permit shall be issued for jobs involving work at height greater than 1.8 m. A separate permit that is, working at height permit shall be issued for working at height.

➤ **Radiography**

For jobs of radiography on pipelines/equipments, isolation and restoration of radioactive source is essential. A separate permit that is radiation permit shall be issued for works related to radiography.

**8) IS 10245 (PART 2) : 2023 RESPIRATORY PROTECTIVE DEVICES-
SPECIFICATION PART 2 SELF-CONTAINED OPEN CIRCUIT BREATHING
APPARATUS**

SCOPE

This standard specifies minimum performance requirements for self-contained open-circuit breathing apparatus with full face mask used as respiratory protective devices, except escape apparatus and diving apparatus. Such equipment is intended for use in work situations where the risk of over pressurization of the cylinders due to hot environmental conditions is low. Laboratory and practical performance tests are included for the assessment of compliance with the requirements.

CLASSIFICATION

Self-contained open circuit breathing apparatus are classified into the following classes according to the purpose:

- a) Class 1 — Apparatus for industrial use
- b) Class 2 — Apparatus for fire fighting

DESIGN

- The apparatus shall satisfy the following requirements when tested. The diameter of pressurized parts with a pressure greater than 0.5 bar downstream of the shut-off valve(s) shall not exceed 32 mm.
- The design of the apparatus shall be such as to allow its inspection in accordance with the information supplied by the manufacturer. All parts requiring manipulation by the wearer shall be readily accessible and easily distinguishable from one another by touch. All adjustable parts and controls shall be constructed so that their adjustment is not liable to accidental alteration during use.
- The apparatus shall be sufficiently robust to withstand the rough usage it is likely to receive in service with respect to its classification.
- The apparatus shall be so designed that there are no protruding parts or sharp edges likely to be caught on projections in narrow passages. The surface of any part of the apparatus likely to be in contact with the wearer shall be free from sharp edges and burrs.
- The apparatus shall be so designed that the wearer can remove it and while still wearing the facepiece, continue to breathe air from the apparatus. The apparatus shall be designed to ensure its full function in any orientation.
- The main valve(s) of the cylinder(s) shall be arranged so that the wearer can operate them while wearing the apparatus.



- If apparatus (of the same class) are designed for use with different sizes of cylinders, changing of cylinders shall be possible without the use of special tools. Where the manufacturer claims the apparatus can be used with a different range of cylinders then the worst case(s) shall be identified and tested.
- Apparatus fitted with more than one cylinder may be fitted with individual valves on each cylinder. It shall not be possible to simultaneously fit two or more cylinders of different rated filling pressures to the same apparatus. It shall also not be possible to fit an apparatus which is designed to operate with a lower rated working pressure to a cylinder with a higher rated filling pressure.

MATERIALS/COMPONENTS

- All the materials used in the construction shall have adequate mechanical strength and resistance to deterioration by heat when tested as per methods.
- Exposed parts, that is, those which may be subjected to impact during practical performance tests shall not be made of magnesium, titanium, aluminium or alloys containing such proportions of these metals which on impact, give rise to frictional sparks capable of igniting flammable gas mixtures.
- Materials that may come into contact with the skin of the wearer shall not be known to be likely to cause irritation or any other adverse effect to health. Testing shall be done accordingly.

CLEANING AND DISINFECTION

- All material shall be visibly unimpaired after cleaning and disinfection by the agents and procedures specified by the manufacturer. Testing shall be done in accordance.

BODY HARNESS

- The body harness shall be designed to allow the user to don and doff the apparatus quickly and easily without assistance and shall be adjustable. The adjustable joints shall be such that once adjusted, they shall not slip inadvertently. Where the body harness incorporates means for attachment of a lifeline, the harness together with the snap hook shall be capable of withstanding a drop test of 1 m when loaded with 75 kg.
- The harness shall be constructed such that when the breathing apparatus is tested for practical performance tests in accordance, the apparatus shall be worn without avoidable discomfort and the wearer shall show no undue sign of strain attributable to wearing the apparatus and the apparatus shall impede the wearer as little as possible when in crouched position or when working in a confined space with restricted movement.
- The body harness shall be considered satisfactory if during the practical performance test it does not slip and continues to hold the apparatus securely to the wearer's body throughout the duration of test.



ASPECT WISE IMPORTANT STANDARDS FORMULATED UNDER OCCUPATIONAL HEALTH & SAFETY SECTIONAL COMMITTEE, CHD 08

1) Respiratory Protective Devices

Product Standard

1.	IS 9473 : 2002	Respiratory protective devices - Filtering half masks to protect against particles - Specification First Revision
2.	IS 10245 (Part 1) : 1996	Breathing apparatus Part 1 closed circuit breathing apparatus Compressed Oxygen Cylinder - Specification First Revision
3.	IS 10245 (Part 2) : 1994	Respiratory protective devices - Specification Part 2 open circuit breathing apparatus First Revision
4.	IS 10245 (Part 3) : 1999	Breathing apparatus Part 3 fresh air hose and compressed air line breathing apparatus - Specification First Revision
5.	IS 10245 (Part 4) : 1982	Specification for breathing apparatus Part 4 escape breathing apparatus Short Duration Self - Contained Type
6.	IS 14138 (Part 1) : 1994	Respiratory protective devices Threads for facepieces - Specification Part 1 standard thread connection
7.	IS 14138 (Part 2) : 1994	Respiratory protective devices Threads for facepieces Part 2 centre thread connection

Method of Test

1.	IS 17274 (Part 1) : 2019	Respiratory Protective Devices Methods of Test and Test Equipment Part 1 Determination of Inward Leakage
2.	IS 17274 (Part 2) : 2019 16900-2: 2017	Respiratory Protective Devices Methods of Test and Test Equipment Part 2 Determination of Breathing Resistance
3.	IS 17274 (Part 3) : 2019 16900-3:2012	Respiratory Protective Devices Methods of Test and Test Equipment Part 3 Determination of Particle Filter Penetration
4.	IS 17274 (Part 5) : 2019 16900-5 :2016	Respiratory Protective Devices Methods of test and test equipment Part 5 Breathing machine metabolic simulator RPD head forms and torso tools and verification tools
5.	IS 17274 (Part 6) : 2019 16900-6:2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 6 Mechanical Resistance Strength of Components and Connections
6.	IS 17274 (Part 7) : 2019 16900-7:2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 7 Practical Performance Test Methods
7.	IS 17274 (Part 8) : 2019 16900-8 :2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 8 Measurement of RPD Air Flow Rates of Assisted Filtering RPD
8.	IS 17274 (Part 9) : 2019 16900-9 : 2015	Respiratory Protective Devices Methods of Test and Test Equipment Part 13 RPD Using Regenerated Breathable Gas and Special Application Mining Escape RPD Consolidated Test for Gas Concentration Temperature Humidity Work of Breathing Breathing Resistance Elastance and Duration

2) Eye & Face Protector

Product Standard

1.	IS 5983 : 1980	Specification for eye - Protectors First Revision
2.	IS 8521 (Part 1) : 2022 ISO 16321-1	Eye and Face Protection for Occupational Use Part 1 General Requirements Second Revision
3.	IS 8521 (Part 2) : 2022 ISO 16321-3	Eye and Face Protection for Occupational Use Part 2 Additional Requirements for Mesh Protectors

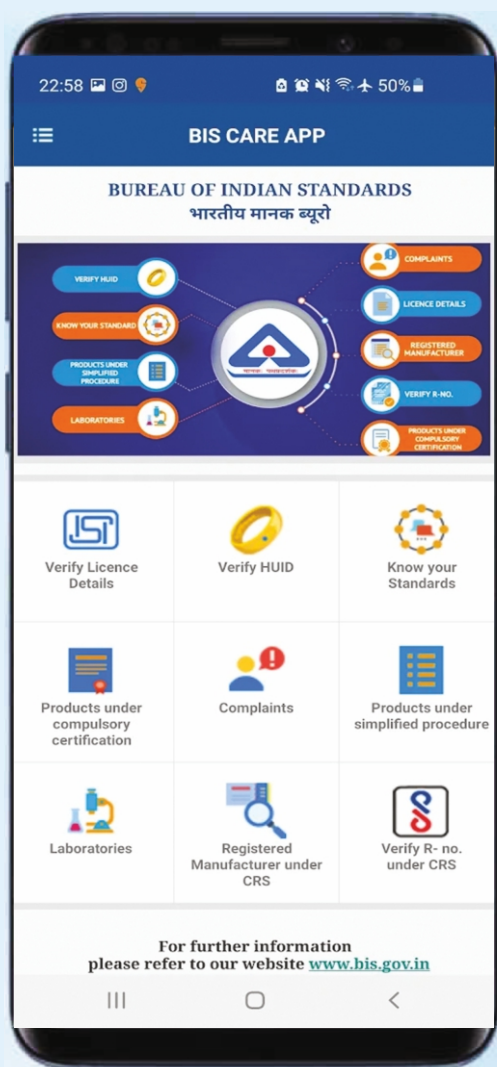
Method of Test

1.	IS 7524 (Part 1) : 2021 ISO 18526-1 : 2020	Eye and Face Protection Test Methods Part 1 Geometrical Optical Properties Second Revision
2.	IS 7524 (Part 2) : 2021 ISO 18526-2 : 2020	Eye and Face Protection Test Methods Part 2 Physical Optical Properties Second Revision
3.	IS 7524 (Part 3) : 2021 ISO 18526-3 : 2020	Eye and face protection Test methods Part 3 Physical and Mechanical Properties
4.	IS 7524 (Part 4) : 2021 ISO 18526-4 : 2020	Eye and face protection Test methods Part 4 Headforms

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