Annex VI*

List of Chemical and Biological Items, Materials, Equipment, Goods and Technologies Related to Other Weapons of Mass Destruction Programs

Subject to the provisions of paragraph 8(a), 8(b), and 8(c) of Resolution 1718 (2006) for the DPRK sanctions regime (corresponding with document S/2006/853)

CHEMICAL PRECURSORS
S/2006/853 ANNEX

1,3-Bis(2-chloroethylthio)-n-propane (63905-10-2)

Also known as: 1,3-Bis[(2-chloroethyl)sulfanyl]propane
Molecular Formula: C7H14Cl2S2

1,4-Bis(2-chloroethylthio)-n-butane (142868-93-7)

Also known as: 1,4-Bis[(2-chloroethyl)sulfanyl]butane
Molecular Formula: C8H16Cl2S2

1,5-Bis(2-chloroethylthio)-n-pentane (142868-94-8)

Also known as: 142868-94-8 Pentane 1,5-bis((2-chloroethyl)thio)
Molecular Weight: 261.27522

2-Chloroethanol (107-07-3)

Also known as: Ethylene Chlorohydrin
Molecular Formula: C2H5ClO
Molecular Weight: 80.5135
Description: Used as a solvent, in the manufacture of insecticides, and for treating sweet potatoes before planting. Colorless liquid with a faint, ether-like odor (http://pubchem.ncbi.nlm.nih.gov)
Methods of Manufacturing: Reaction of Ethylene Oxide & Aqueous Metallic Chlorides. Made from Ethylene by the action of a Hypochlorite. 2-Chloroethanol can be synthesized by reaction of hypochlorous acid with ethylene.
Chemical Vendors:  
- ABI Chem  SID 104293656 - External ID: AC1L18BV  
- AKos Consulting & Solutions  SID 104667463 - External ID: AKOS000119040  
- Amadis Chemical  SID 131293923 - External ID: A801572  
- Ambinter  SID 102852066 - External ID: BB_SC-7062  
- Angene Chemical  SID 136394067 - External ID: AG-C-83527  
- Angene International  SID 124366974 - External ID: AG-D-21927  
- Chembase.cn  SID 162217751 - External ID: 123398  
- ChemExper Chemical Directory  SID 3132405 - External ID: qCbPXQBRu@  
- ChemFrog  SID 125337376 - External ID: 888-885-005  
- ChemMol  SID 126676601 - External ID: 49415250  
- FINETECH  SID 164797095 - External ID: FT-0611939  
- IS Chemical Technology  SID 92252222 - External ID: I14-6282  
- MolPort  SID 88520013 - External ID: MolPort-000-872-024  
- Sigma-Aldrich  SID 24851176 - External ID: 185744_ALDRICH  
- Vitas-M Laboratory  SID 125326146 - External ID: BBL011477  

Storage Conditions:  Glass Bottle  

2-Chloroethylchloromethylsulfide (2625-76-5)  
No further information.  

3-Hydroxy-1-methylpiperidine (3554-74-3)  

Also known as:  1-Methylpiperidin-3-ol  
- 1-Methyl-3-piperidinol  
Molecular Formula:  C6H13NO  
Molecular Weight:  115.17352  
Chemical Vendors:  
- AAA Chemistry  SID 103101611 - External ID: AR-1C4742  
- ABBLIS Chemicals  SID 136023200 - External ID: AB1011621  
- ABI Chem  SID 104422405 - External ID: AC1L3ZO8  
- DIC  SID 117617376 - External ID: AC1Q7AOT  

(www.Sigmaaldrich.com)
3-Quinuclidinol (1619-34-7)

Also known as: 1-Methylpiperidin-3-ol
1-Methyl-3-piperidinol

Molecular Formula: C7H13NO
Molecular Weight: 127.18422

Description: Cream colored crystalline powder (http://pubchem.ncbi.nlm.nih.gov)

Methods of Manufacturing:
Synthesis: 3-Quinuclidinone hydrochloride and hydrogen

Chemical Vendors:
ABBLIS Chemicals SID 118043430 - External ID: AB1004818
ABI Chem SID 104337005 - External ID: AC1L2550
SID 117617440 - External ID: AC1Q7AQL
SID 117617441 - External ID: AC1Q7AQM
AKos Consulting & Solutions SID 145469526 - External ID: AKOS009158263
3-Quinuclidone (3731-38-2)

Also known as: Quinuclidin-3-one
Molecular Formula: C7H11NO
Chemical Vendors: ABI Chem
                      SID 104348004 - External ID: AC1L2E9J
                      SID 117591624 - External ID: AC1Q6ETJ
AKos Consulting & Solutions
                      SID 104668151 - External ID: AKOS000119728
                      SID 152088712 - External ID: AKOS015949293
Amadis Chemical
                      SID 126726012 - External ID: A15154
                      SID 131312477 - External ID: A823593
Alkyl (Me, Et, n-Pr or i-Pr) phosphonyldifluorides

No further information.

Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate and corresponding alkylated or protonated salts (78-53-5)

No further information.
Ammonium bifluoride (1341-49-7)

Also known as: Acid ammonium fluoride
Ammonium fluoride

Molecular Formula: F2H5N
Molecular Weight: 57.043206


Methods of Manufacturing:
Prepared from hydrofluoric acid and ammonia. Action of ammonium hydroxide on hydrofluoric acid with subsequent crystallization. Anhydrous ammonium bifluoride containing 0.15 H2O and 93% NH4HF2 can be made by dehydrating ammonia fluoride solutions and by thermally decomposing the dry crystals. Commercial ammonium bifluoride, which usually contains 1% NH4F, is made by gas phase reactions of one mole of anhydrous ammonia with two moles of anhydrous hydrogen fluoride; the melt that forms is flaked on a cooled drum.

Chemical Vendors: ABI Chem SID 104335775 - External ID: AC1L24TU
Ambinter SID 95690383 - External ID: PC1104
Chembase.cn SID 162080555 - External ID: 93900
ChemFrog SID 125363556 - External ID: 888-846-691
ChemMol SID 126691165 - External ID: 49429815

Storage Conditions: Solution /USP topical fluoride solution/ should be stored in Plax (plastic), paraffin lined, or pyrex bottles. (http://pubchem.ncbi.nlm.nih.gov)

Arsenic trichloride (7784-34-1)

Also known as: Arsenic(III) chloride
Trichloroarsine
Arsenic chloride
Arsenous trichloride,
Arsenic butter
Arsenous chloride
Arsenious chloride

Molecular Formula: AsCl3
Molecular Weight: 181.2806

Description: Used as a chemical intermediate for pharmaceuticals, insecticides, and chemical warfare blister agents; Used in the ceramics industry; [HSDB] Oily liquid, Colorless liquid, Acrid odor (http://pubchem.ncbi.nlm.nih.gov)

Methods of Manufacturing:
Arsenic trichloride may be formed by the following reactions: (1) chlorine with arsenic trioxide, (2) sulfur monochloride, S2Cl2, or a mixture of S2Cl2 and chlorine with arsenic trioxide; and (3) arsenic trioxide with a mixture of sulfuric acid and a chloride. (1) By action of chlorine on arsenic; (2) by distillation of arsenic trioxide with concentrated hydrochloric acid. Arsenic chloride is produced from dry etching process of gallium arsenide wafers in chlorofluorocarbons.

Chemical Vendors:
- ABI Chem
  - SID 104360009 - External ID: AC1L2NJ0
  - SID 117452600 - External ID: AC1Q3FJQ
  - SID 117452601 - External ID: AC1Q3FJR
- Angene Chemical
  - SID 136484918 - External ID: AG-G-20166
- Angene International
  - SID 126513512 - External ID: AG-H-11941
- Chembase.cn
  - SID 162220282 - External ID: AC1Q3FJR
- ChemFrog
  - SID 125811786 - External ID: 888-994-265
- FINETECH
  - SID 164806576 - External ID: FT-0622483
- IS Chemical Technology
  - SID 144101950 - External ID: I14-101603
- Sigma-Aldrich
  - SID 24851956 - External ID: 200077_ALDRICH

Storage Conditions:
- Separate from acids, alkalies. Store in a cool, dark, dry, well-ventilated location.

Benzilic acid (76-93-7)

Also known as:
- 2,2-diphenyl-2-hydroxyethanoic acid
- Diphenylglycolic acid
- Benzylic acid
- Hydroxy(diphenyl)acetic acid

Molecular Formula:
- C14H12O3

Molecular Weight:
- 228.24328

Description:
- White to tan powder

Methods of Manufacturing:
- Prepared from benzil by the action of concentrated aqueous or alc KOH.
- Synthesis: Benzoin, nitric acid, ethanol, NaOH, and water.

Chemical Vendors:
- AAA Chemistry
  - SID 103826333 - External ID: AR-1J2132
- ABI Chem
  - SID 104312132 - External ID: AC1L1ML3
  - SID 117544093 - External ID: AC1Q5SN4
  - SID 117605853 - External ID: AC1Q71SQ
- AKos Consulting & Solutions
  - SID 104669371 - External ID: AKOS000120948
- Ambinter
  - SID 81091235 - External ID: BB_SC-0097
- Ark Pharm, Inc.
  - SID 163411225 - External ID: AK112794
- Chembase.cn
  - SID 162094986 - External ID: 109181
- ChemExper Chemical Directory

**Bis(2-chloroethylthio)methane (63869-13-6)**

- Also known as: 1-Chloro-2-(((2-chloroethyl)sulfanyl)methyl)sulfanyl)ethane
- Molecular Formula: C5H10Cl2S2
- Chemical Vendor: ABI Chem

Bis(2-chloroethylthiomethyl)ether (63918-90-1)

- Also known as: Ethane, 1,1’-(oxybis(methylene))bis(2-chloro-

**BZ: 3-Quinuclidinyl benzilate (6581-06-2)**

- Also known as: 3-Quinuclidinyl benzilate
  BZ [anticholinergic]
  3-Chinoclidylbenzilate
3-Quinuclidyl benzilate
3-Quinuclidinol benzilate

Molecular Formula: C21H23NO3
Molecular Weight: 337.41222

Description: A high-affinity muscarinic antagonist commonly used as a tool in animal and tissue studies. Colorless liquid, odorless to fruity.

Methods of Manufacturing:
Benzilate ester of 3-quinuclidinol formed through acetone-ether actions on parent compound.

Chemical Vendors: ABI Chem
SID 104357474 - External ID: AC1L2LKL
SID 117575092 - External ID: AC1Q622B

Angene Chemical
SID 136498601 - External ID: AG-G-47733

Chembase.cn
SID 162091572 - External ID: 103953

ChemFrog
SID 125670405 - External ID: 888-728-787

MP Biomedicals
SID 85089131 - External ID: 153697
SID 85089132 - External ID: 198796

Chloropicrin: Trichloronitromethane (76-06-2)

Also known as: Trichloronitromethane
Nitrotrichloromethane
trichloro(nitro)methane
Chloropicrine
Chlorpikrin
Dojyopicrin
Nitrochloroform
Dolochlor

Molecular Formula: CCl3NO2
Molecular Weight: 164.3752

Description: Used as a grain, crop, and soil fumigant; also used as an intermediate in organic synthesis and a warning odorant for odorless fumigants and gases. Colorless to faint-yellow, oily liquid with an intensely irritating odor.

Methods of Manufacturing:
Chloropicrin is formed by chlorinating nitromethane or picric acid with alkali metal or alkaline earth hypochlorites or by treating acetone with concentrated nitric and hydrochloric acids.

Chemical Vendors: AAA Chemistry
SID 103846705 - External ID: AR-1L2507

ABI Chem
SID 104312021 - External ID: AC1L1MI0
SID 117377050 - External ID: AC1Q1WP7
Chlorosarin: O-Isopropyl methylphosphonochloridate (1445-76-7)

Also known as: Chlorosarin
Imcl-2-propyl
AC1L2S6Y
AC1Q3VG8
HSDB 7671
isopropyl methylphosphonic chloride
Isopropyl methylphosphonochloridoate

Molecular Formula: C4H10ClO2P
Molecular Weight: 156.547762

Methods of Manufacturing:
Synthesis: DIMP, O-O-diisopropyl methylphosphonate

Chemical Vendors: AAA Chemistry SID 103817159 - External ID: AR-112085
ABI Chem SID 104366055 - External ID: AC1L2S6Y
SID 117473210 - External ID: AC1Q3VG8
Chembase.cn SID 162220875 - External ID: 126543

Chlorosoman: O-Pinacolyl methylphosphonochloridate (7040-57-5)

Storage Conditions: Store in a cool, dry, well-ventilated location. Separate from oxidizing materials. Outside or detached storage is preferred. Do not use magnesium, aluminum or their alloys for handling equipment or containers. Be sure container is closed completely. Store in cool, well-ventilated place. Not for use or storage in or around home. The chemical attacks iron but forms protective coating and hence can be stored in iron or galvanized iron. Store in ambient temperature. Vent with pressure-vacuum. Keep containers tightly closed, and store in a cool and dark place. Separate from sources of ignition or heat.

Chlorosoman: O-Pinacolyl methylphosphonochloridate (7040-57-5)
Also known as: Chlorosoman
CCRIS 5731
O-Pinacolyl methylphosphonochloridate
BRN 2076660
Methylphosphonochloridic acid 1,2,2-trimethylpropyl ester

Molecular Formula: C7H16ClO2P

Methods of Manufacturing:
Synthesis: methyl-phosphonic dichloride and pinacol

Chemical Vendors:
ABI Chem SID 104412859 - External ID: AC1L3SB2

Cyanogen chloride (506-77-4)

Also known as: Chlorine cyanide
Chlorocyanide
Chlorocyanogen
Chlorocyan
Chlorocyan
Cyanic chloride
Caswell No. 267
Chlorine cyanide (CICN)

Molecular Formula: CClN
Molecular Weight: 61.4704

Description: Used in organic synthesis and as a military poison gas; may be generated in a reaction of hypochlorite and cyanide solutions in waste water treatment; [ACGIH] Used in metal cleaning and ore refining; [ATSDR ToxProfiles]. Colorless gas or liquid (below 55° F) with an irritating odor;

Methods of Manufacturing:
The preparation of the industrially important CICN has been developed extensively; the synthetic pathways are as follows: (1) Electrolysis of an aqueous solution of HCN and NH4Cl. (2) Reaction of complex cyanide salts (e.g., Na2(Zn(CN)4)) with chlorine below 20° C. (3) Formation of CICN from cyanide salts (mostly NaCN) and chlorine in an exothermic reaction; in a continuous process, sprayed aqueous NaCN solution is contacted with chlorine, and the reaction heat evaporates the CICN. (4) Processes involving hydrogen cyanide and chlorine as the most convenient starting materials; the reaction is carried out in aqueous solution ... in organic and inorganic solvents, and in the gas phase. To avoid the byproduct HCl, attempts have been made to reoxidize HCl to chlorine with oxygen and hydrogen peroxide in catalyzed reactions. (5) Chlorinolysis of
cyanogen in the gas phase at 300–600° C in the presence of a catalyst. (6) Pyrolysis of cyanuric chloride at 600–900° C in the presence of a charcoal catalyst. (7) High-temperature syntheses based on elemental chlorine, nitrogen, and carbon. Usually, these processes lead to impure ClCN; therefore, in many cases the product must be purified before further use.

**Chemical Vendors:**
- ABI Chem
- AKos Consulting & Solutions
- Chembase.cn
- ChemFrog
- ChemMol
- FINETECH
- IS Chemical Technology

**Storage Conditions:**
Cyanogen chloride must be labeled: "Poison Gas, Flammable Gas." It falls in DOT Hazard Class 2.3 and Packing Group I. Shipment by passenger aircraft or railcar or even cargo aircraft is forbidden. Fireproof if in building. Provision to contain effluent from fire extinguishing. Cool. A harmful concentration of this gas in the air will be reached very quickly on loss of containment. In most cases, cyanogen chloride is used in the gas phase immediately after preparation. Relatively small amounts are condensed and stored in gas containers as liquids. Steel cylinders, which must meet specific requirements in each country, can be used for shipment. The condensed and bottled cyanogen chloride must be very pure; moreover, it must be mixed with a stabilizing agent (generally sodium pyrophosphate) to inhibit exothermic polymerization caused by impurities.

**Dialkyl (Me, Et, n-Pr or i-Pr) N,N-dialkyl (Me, Et, n-Pr or i-Pr)-Phosphoramidates**

No further information.

**Diethyl ethylphosphonate (78-38-6)**

- **Also known as:** Phosphonic acid
- Ethyl-
- Diethyl ester
- Ethane phosphonic acid

- **Molecular Formula:** C6H15O3P
- **Molecular Weight:** 166.155262
- **Description:** Used for heavy-metal extraction and solvent separation; Also used as a gasoline additive, antifoam agent, plasticizer, textile conditioner, and antistatic agent.

**Manufacturers:** Mobil Oil Corp, Mobil Chem CO, Div, Phosphorus Div, Charleston, SC

**Chemical Vendors:**

- AAA Chemistry SID 103824698 - External ID: AR-114694
- ABI Chem SID 104312334 - External ID: ACIL1MQP
- SID 117443204 - External ID: AC1Q38AP
- SID 117628041 - External ID: AC1Q6SSL
- Achemica SID 162305176 - External ID: ACMC-20al8u
- AKos Consulting & Solutions SID 151978429 - External ID: AKOS015839010
- Ambinter SID 118845909 - External ID: ST51055152
- Angene Chemical SID 136525446 - External ID: AG-K-71965
- Ark Pharm, Inc. SID 163412822 - External ID: AK114415
- Chembase.cn SID 162039846 - External ID: 74928
- ChemFrog SID 125357735 - External ID: 888-847-254
- FINETECH SID 164808755 - External ID: FT-0624781
- IS Chemical Technology SID 90343071 - External ID: I14-4559
- King Scientific SID 163809190 - External ID: KSC492SD
- MolPort SID 88802611 - External ID: MolPort-001-759-626
- MP Biomedicals SID 51074193 - External ID: 202968
- Sigma-Aldrich SID 24869763 - External ID: 46089_FLUKA
- TCI (Tokyo Chemical Industry) SID 125309303 - External ID: E0483
- ZINC SID 12077978 - External ID: ZINC01641072


**Storage Conditions:** In general, materials which are toxic as stored or which can decom into toxic component should be stored in a cool, well-ventilated place, out of direct rays of the sun, away from areas of high fire hazard, and should be periodically inspected. Incompatible materials should be isolated from each other. ([http://pubchem.ncbi.nlm.nih.gov](http://pubchem.ncbi.nlm.nih.gov))

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**Diethyl methylphosphonate (683-08-9)**

**Also known as:** Diethyl methanephosphonate
Phosphonic acid, methyl-
Diethyl ester

**Molecular Formula:** C₅H₁₃O₃P


**Chemical Vendors:**

- ABI Chem SID 104329686 - External ID: AC1L204P
- Achemica SID 162267990 - External ID: AC1M-1B13H
- AKos Consulting & Solutions SID 152055037 - External ID: AKOS015915618
- Ambinter SID 84934246 - External ID: OR10722

Diethyl methylphosphonite (15715-41-0)

Also known as: Methyldiethoxyphosphine
Molecular Formula: C5H13O2P
Chemical Vendors: ABI Chem SID 104387492 - External ID: AC1L38QF
Achemica SID 162304545 - External ID: ACMC-20akel
AKos Consulting & Solutions SID 132506498 - External ID: AKOS006223871
Amadis Chemical SID 126728336 - External ID: A19423
Angene Chemical SID 136783469 - External ID: AG-E-06104
ChemFrog SID 125378019 - External ID: 888-877-772
FINETECH SID 164808768 - External ID: FT-0624794
IS Chemical Technology SID 135377813 - External ID: I14-53530
MolPort SID 88802619 - External ID: MolPort-001-759-634
Sigma-Aldrich SID 24856263 - External ID: 268119_ALDRICH
TCI (Tokyo Chemical Industry) SID 87557833 - External ID: D3827
ZINC SID 12087536 - External ID: ZINC02031441

Diethyl N,N-dimethylosphoramidate (2404-03-7)

Also known as: N,N-Dimethyl O,O'-diethyl phosphoramidate
Diethyl dimethylphosphoramidate
Molecular Formula: C6H16NO3P
Chemical Vendors: ABI Chem SID 109764591 - External ID: AC1LATOB
Angene Chemical

SID 136863073 - External ID: AG-E-70904

Storage: No storage conditions or transportation requirements specified.

Diethyl phosphite (762-04-9)

Also known as:
- Diethyl hydrogen phosphite
- Diethoxophosphine oxide
- Diethyl acid phosphate
- Diethyl phosphonate
- Diethylfosfit [Czech]
- Ethyl phosphonate ((EtO)2HPO)
- Hydrogen diethyl phosphate
- O,O- Phosphonic acid diethyl ester

Molecular Formula: C4H10O3P+
Molecular Weight: 137.094162

Description:
Used as a paint solvent, reducing agent, phosphorylating agent, textile finishing agent, antioxidant, additive for adhesives and extreme pressure lubricants, and intermediate for flame-retardants, insecticides, and other organic phosphorus compounds; Scheduled 3B precursor to VG, sarin, soman, and GF. Water-white liquid; [Hawley] Clear colorless liquid; May decompose on exposure to moisture.

Manufacturers:
Supresta US LLC, 420 Saw Mill River Rd., Ardsley Park, Ardsley, NY 10502, (914) 269-5900; Production site: Gallipolis Ferry, WV 25515-1721

Chemical Vendors:
- ABI Chem SID 114450428 - External ID: AC1O3G55
- AKos Consulting & Solutions SID 145340177 - External ID: AKOS009028914
- Amadis Chemical SID 131325797 - External ID: A838641
- Ambinter SID 118306523 - External ID: SBB056825
- Ark Pharm, Inc. SID 163409122 - External ID: AK110143
- Chembase.cn SID 160965974 - External ID: 2524
- ChemExper Chemical Directory SID 3132870 - External ID: KAxY@PfAxIujmUP@@
- Chemical Synthesis Database SID 126572099 - External ID: 762-04-9
- ChemMol SID 126676268 - External ID: 49414917
- MolPort SID 89085479 - External ID: MolPort-002-042-530
- MP Biomedicals SID 85085409 - External ID: 150901
- Sigma-Aldrich SID 24859446 - External ID: 32449_FLUKA
- SID 24859447 - External ID: 32450_FLUKA
- SID 24862594 - External ID: 365920_ALDRICH
- SID 24894335 - External ID: D99234_ALDRICH
- TCI (Tokyo Chemical Industry) SID 125308989 - External ID: D0521
Diethylaminoethanol (100-37-8)

Also known as: 2-(Diethylamino)ethanol
N,N-Diethylethanolamine
(Diethylamino)ethanol
DEAE
Diethylethanolamine
N,N-Diethyl-2-aminoethanol

Molecular Formula: C6H15NO
Molecular Weight: 117.1894


Pelron Corporation, 7847 West 47th St, PO Box 6, Lyons, IL 60534 (708) 442-9100.

Union Carbide Corporation, Hq, Old Ridgebury Rd, Danbury, CT 06817 (203) 794-2000; Specialty Chemicals Division, Production site: South Charleston, WV 25303.

Chemical Vendors: AAA Chemistry SID 103118054 - External ID: AR-1E1189
ABI Chem SID 104315124 - External ID: AC1L1OW7
SID 117431650 - External ID: AC1Q2ZDQ
SID 117431651 - External ID: AC1Q2ZDR
AKos Consulting & Solutions SID 104668306 - External ID: AKOS000119883
Ambinter SID 102851809 - External ID: BB_SC-6638
BroadPharm SID 143504456 - External ID: BP-20552
Chembase.cn SID 162217673 - External ID: 123320
ChemFrog SID 125336384 - External ID: 888-884-032
Chemical Synthesis Database SID 126546471 - External ID: 100-37-8
IS Chemical Technology SID 85174104 - External ID: I05-0201
Jamson Pharmachem Technology SID 93616649 - External ID: Jsp000103
Sigma-Aldrich SID 24859090 - External ID: 31760_FLUKA
UN Sanctions on Iran and North Korea

SID 24870721 - External ID: 471321_ALDRICH
TCI (Tokyo Chemical Industry) SID 87567139 - External ID: D0465
TimTec SID 143432981 - External ID: SBB058521
TimTec SID 143826062 - External ID: STS1023433
Vitas-M Laboratory SID 125326867 - External ID: BBL012211
Vitas-M Laboratory SID 125292617 - External ID: STL163552


Storage Conditions: Separate from strong oxidants and strong acids. Store in fireproof, cool, and dry environment.

Packaging and Labeling: C symbol
R: 10-20/21/22-34
S: 1/2-36/37/39-45
UN Hazard Class: 8
UN Subsidiary Risks: 3
UN Packing Group: II

Standard Transportation Number:
49 131 86; Diethylaminoethanol

Diisopropylamine (108-18-9)

Also known as:
DIPA, N-(1-Methylethyl)-2-propanamine
N,N-Diisopropylamine
2-Propanamine
N-(1-methylethyl)-
N-Isopropyl-1-amino-2-methylethane

Molecular Formula: C6H15N

Description:
Colorless liquid with an ammonia- or fish-like odor;

Manufacturers:
Air Products and Chemicals, Inc, Hq, 7201 Hamilton Blvd, Allentown, PA 18195-1501, (610) 481-4911; Chemicals Group (800) 345-3148, Industrial Chemicals Division; Production sites: Pace, FL 32571; St Gabriel, LA 70776.

Elf Atochem North America Inc, Hq, Three Parkway, Philadelphia, PA 19102 (215) 587-7000; Organic Chemicals Division; Production site: Riverview, MI 48192 (313) 285-9200.

Chemical Vendors:
ABI Chem SID 104316347 - External ID: AC1L1PU6
ABI Chem SID 117368710 - External ID: AC1Q1Q9J
Achemica SID 162274832 - External ID: ACMC-1C066
AKos Consulting & Solutions SID 104668576 - External ID: AKOS000120153
Ambinter SID 118308702 - External ID: SBB059763
Angene Chemical SID 136383119 - External ID: AG-C-93661
Angene International SID 124367137 - External ID: AG-D-24377
UN Sanctions on Iran and North Korea

Anward    SID 160783406 - External ID: ANW-15905
Chembase.cn SID 162040009 - External ID: 75091
ChemExper Chemical Directory SID 3135177 - External ID: sNx@@eLuUP@
ChemFrog SID 125337512 - External ID: 888-885-686
ChemMol SID 126653018 - External ID: 44006041
SID 126676636 - External ID: 49415285
SID 126690235 - External ID: 49428885
FINETECH SID 164808980 - External ID: FT-0625007
IS Chemical Technology SID 92251968 - External ID: I14-6017
King Scientific SID 163802823 - External ID: KSC175O6B
MolPort SID 88802210 - External ID: MolPort-001-759-225
MP Biomedicals SID 85085482 - External ID: 157754
SID 56367348 - External ID: 202034
Oakwood Products SID 117648666 - External ID: 005001
Sigma-Aldrich SID 24863920 - External ID: 38290_FLUKA
SID 24864094 - External ID: 386464_ALDRICH
SID 57649857 - External ID: 386464_SIAL
SID 24870705 - External ID: 471224_ALDRICH
SID 57650897 - External ID: 471224_SIAL
TCI (Tokyo Chemical Industry) SID 125309058 - External ID: D0925
TimTec SID 143434189 - External ID: SBB059763
SID 144021183 - External ID: ST45255383
Vitas-M Laboratory SID 152166697 - External ID: STL264227

Storage Conditions: Store in a cool, dry, and well-ventilated location. Separate from acids; oxidizing material, plastics.

Packaging and Labeling: F symbol
C symbol
R: 11-20/22-34
S: 1/2-16-26-36/37/39-45
UN Hazard Class: 3
UN Subsidiary Risks: 8
UN Packing Group: II

**Dimethyl ethylphosphonate (6163-75-3)**

No further information.

**Dimethyl methylphosphonate (756-79-6)**

Also known as: Dimethoxymethyl phosphine oxide
Dimethyl methanephosphonate
Dimethyl methylphosphonate
DMMP
Furan TF 2000
Fyrol DMMP
Metaran
Methane phosphonic acid dimethyl ester
Methyl phosphonic acid dimethyl ester
NCI-C54762
O,O-Dimethyl methylphosphonate
Reoflam DMMP

Molecular Formula: C₃H₉O₃P


Manufacturers: Rhodia Inc., 8 Cedar Brook Dr., Cranbury, NJ 08512-7500, (609) 860-4000; Consumer Specialties Div.; Production site: Charleston, SC 29405-8339.


Chemical Vendors: ABI Chem SID 104330452 - External ID: AC1L20PZ
SID 117500375 - External ID: AC1Q4GET
SID 117500376 - External ID: AC1Q4GEU
SID 117627484 - External ID: AC1Q6SD4

AKos Consulting & Solutions SID 152052803 - External ID: AKOS015913384

Amadis Chemical SID 131325653 - External ID: A838480

Ambinter SID 84934289 - External ID: OR10773

Angene Chemical SID 136520688 - External ID: AG-H-01683

Angene International SID 126510440 - External ID: AG-H-01683

Anward SID 160804153 - External ID: ANW-36652

Chembase.cn SID 162039902 - External ID: 74984

ChemExper Chemical Directory SID 3209149 - External ID: sNqhHIOAkJvj@ChemFrog SID 125357262 - External ID: 888-845-196

Chemical Synthesis Database SID 126556857 - External ID: 756-79-6

ChemMol SID 126676264 - External ID: 49414913

FINETECH SID 164812104 - External ID: FT-0628285

Hangzhou Trylead Chemical Technology SID 49835010 - External ID: TL8005176

IS Chemical Technology SID 90343070 - External ID: I14-4558

King Scientific SID 163812709 - External ID: KSC498A6N

MP Biomedicals SID 56367527 - External ID: 204081

Sigma-Aldrich SID 24883205 - External ID: 64258_FLUKA
SID 24893515 - External ID: D169102_ALDRICH
TCI (Tokyo Chemical Industry) SID 87572924 - External ID: M0943
ZINC SID 12079908 - External ID: ZINC01691062

Dimethyl phosphite (DMP) (868-85-9)

Also known as: Dimethyl hydrogen phosphite
Bis(hydroxymethyl)phosphine oxide
Dimethoxyphosphine oxide
Dimethyl acid phosphate
Dimethyl hydrogen phosphonate
Dimethyl phosphate
Dimethyl phosphonate
Dimethylester kyselini fosforite [Czech]
Dimethylester kyseliny fosforite [Czech]
Dimethylfosfit [Czech]
Dimethylfosfonat [Czech]
Dimethylhydrogenphosphite
Hydrogen dimethyl phosphate
Methyl phosphonate ((MeO)2HPO)
Phosphonic acid
Dimethyl ester

Molecular Formula: C2H6O3P+
Description: Mobile, colorless liquid. Mild odor.

Manufacturer: Rhodia Inc., 259 Prospect Plains Road, CN 7500, Cranbury, NJ 08512-7500, (609) 860-4000, Consumer Specialties Division; Production site: Charleston, SC 29405-8339

Chemical Vendors: ABI Chem SID 114449163 - External ID: AC1O3F60
Achemica SID 162300844 - External ID: ACMC-209vzo
AKos Consulting & Solutions SID 152052916 - External ID: AKOS015913497
Ambinter SID 118309405 - External ID: SBB060964
Angene Chemical SID 13680557 - External ID: AG-F-05728
Anward SID 160813228 - External ID: ANW-45730
Chembase.cn SID 162233175 - External ID: 138924
ChemFrog SID 125358849 - External ID: 888-849-471
ChemMol SID 126690322 - External ID: 49428972
FINETECH SID 164809015 - External ID: FT-0625043
IS Chemical Technology SID 90343072 - External ID: I14-4560
MolPort SID 91695336 - External ID: MolPort-003-932-293
Sigma-Aldrich SID 24865933 - External ID: 41430_FLUKA
UN Sanctions on Iran and North Korea

SID 24893543 - External ID: D178454_ALDRICH
TCI (Tokyo Chemical Industry) SID 125309024 - External ID: D0786
TimTec SID 143435026 - External ID: SBB060964
SID 143801952 - External ID: ST51047049

Storage Conditions: Store in a dry area without drain or sewer access. Separated from food and feedstuffs. (http://www.cdc.gov/niosh)

**Dimethylamine hydrochloride (506-59-2)**

Also known as: A13-52357
- Dimethylamine hydrochloride
- Dimethylammonium chloride
- EINECS 208-046-5
- Hydrochloric acid dimethylamine
- N-Methylmethanamine hydrochloride
- UNII-7M4CWB6AOK

**Dimethylamine (124-40-3)**

Also known as: N-Methylmethanamine
- Methanamine
- N-methyl-
- N,N-Dimethylamine
- Dimethylamine solution
- Dimethyl-amine
- Dimethylamine (anhydrous)
- DMA
- A13- 15638- X

Molecular Formula: C2H7N
Description: Colorless gas with an ammonia- or fish-like odor

Manufacturers: Air Products and Chemicals, Inc., Chemicals group, Industrial Chemical Division, 7201 Hamilton Blvd., Allentown, PA 18195-1501 (610) 481-4911; Production site: Pace, FL 32571

E.I. DuPont Specialty Chemicals, 1007 Market St., Wilmington, DE 19898, (302) 744-1000
DuPont Safety & Protection. DuPont Chemical Solutions Enterprise, (302) 892-8254; Production site: Belle, WV 25015.

Chemical Vendors:

- ABI Chem
  - SID 1042995517 - External ID: AC1L19RK
  - SID 117479750 - External ID: AC1Q40HW
  - SID 117479751 - External ID: AC1Q40HX
  - SID 117479752 - External ID: AC1Q40HY

- Achemica
  - SID 162271410 - External ID: ACMC-1BQ2Z

- AKos Consulting & Solutions
  - SID 145279429 - External ID: AKOS008968166

- Ambinter
  - SID 83620198 - External ID: LTBB000394

- Angene Chemical
  - SID 136386947 - External ID: AG-C-93676

- Chembase.cn
  - SID 162041972 - External ID: 77098

- ChemExper Chemical Directory
  - SID 3135678 - External ID: QM`BN`@

- ChemFrog
  - SID 125363202 - External ID: 888-846-966

- ChemMol
  - SID 126687952 - External ID: 49426602

- FINETECH
  - SID 164809086 - External ID: FT-0625114

- IS Chemical Technology
  - SID 125330871 - External ID: I14-17993

- King Scientific
  - SID 163802726 - External ID: KSC175G1R

- MolPort
  - SID 88826797 - External ID: MolPort-001-783-813

- Oakwood Products
  - SID 124392010 - External ID: 044754

- Sigma-Aldrich
  - SID 24857770 - External ID: 295280_ALDRICH
  - SID 24864215 - External ID: 388246_ALDRICH
  - SID 57649875 - External ID: 38931_ALDRICH
  - SID 24864274 - External ID: 38931_FLUKA
  - SID 24864412 - External ID: 391956_ALDRICH
  - SID 24866705 - External ID: 426458_ALDRICH

- TCI (Tokyo Chemical Industry)
  - SID 125309006 - External ID: D0643
  - SID 87559181 - External ID: D3292
  - SID 125307284 - External ID: D3936
  - SID 160871446 - External ID: D3948

- Vitas-M Laboratory
  - SID 152166339 - External ID: STL263869
  

Storage Conditions: Store in a fireproof, cool area. They are extremely flammable products that should be stored in a well-ventilated area and protected from fire risk. Avoid oxidizing materials, acids, and sources of halogens. Store in cool, dry, well-ventilated, noncombustible location. Protect containers against physical damage. Outdoor or detached storage is preferable. Indoor storage of gas should be in a cool, well-ventilated, noncombustible location, away from all possible sources of ignition. Insure against accidental contact with mercury.

Packaging and Labeling: F+ symbol

Xn symbol

R: 12-20-37/38-41
S: 2-16-26-39
UN Sanctions on Iran and North Korea

UN Hazard Class: 2.1

Shipping Conditions: This compound requires a shipping label of: "Poison Gas, Flammable Gas." It falls into DOT Hazard Class 2.1. Passenger aircraft or railcar shipment is forbidden and cargo aircraft shipment is forbidden as well. (http://pubchem.ncbi.nlm.nih.gov and www.cdc.gov/niosh)

Ethyldiethanolamine (139-87-7)

Also known as: Ethyldiethanolamine
Ethanol, 2,2'-(ethylimino)bis-
ETHYL DIETHANOLAMINE
Diethanolethylamine
139-87-7, 2,2'-Ethyliminodiethanol
TL 596

Molecular Formula: C6H15NO2

Description: Water-white liquid, Yellow liquid, Amine odor (http://pubchem.ncbi.nlm.nih.gov)

Manufacturers: Tamino, Inc., 1303 Blyd Avenue, N.W., Atlanta, GA 30318, (404) 351-3324; Production site: Riverview, MI 48192

Chemical Vendors: ABI Chem SID 104318709 - External ID: AC1L1RNS
Achemica SID 162304300 - External ID: ACMC-20ak4r
AKos Consulting & Solutions SID 145375412 - External ID: AKOS009064149
Ambinter SID 118307908 - External ID: SBB058753
Angene Chemical SID 136424772 - External ID: AG-D-80213
Ark Pharm, Inc. SID 164122082 - External ID: AK-54555
Chembase.cn SID 162087224 - External ID: 106750
ChemExper Chemical Directory SID 3135252 - External ID: HiFD@L@TeYvj`@@
ChemMol SID 126677297 - External ID: 49415946
FINETECH SID 164847297 - External ID: FT-0694417
IS Chemical Technology SID 135374407 - External ID: I14-44857
MP Biomedicals SID 56368833 - External ID: 201303
Sigma-Aldrich SID 24847063 - External ID: 112062_ALDRICH
TCI (Tokyo Chemical Industry) SID 87569416 - External ID: E0111
TimTec SID 143433196 - External ID: SBB058753
SID 143838840 - External ID: ST51037894

Ethylphosphinyl dichloride (1498-40-4)

Also known as: Ethyldichlorophosphine
Ethyl phosphonous dichloride
1498-40-4, Phosphate
Dichloroethyl-
Dichlor-ethylfosfin [Czech]
EINECS 216-096-4
Dichloroethylphosphine

<table>
<thead>
<tr>
<th>Molecular Formula:</th>
<th>C2H5Cl2P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Colorless liquid with a pungent odor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Vendors:</th>
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<tbody>
<tr>
<td>ABI Chem</td>
<td>SID 104336368 - External ID: AC1L25AB</td>
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<tr>
<td>AKos Consulting &amp; Solutions</td>
<td>SID 152053718 - External ID: AKOS015914299</td>
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<td>CAPOT</td>
<td>SID 152249624 - External ID: 6479</td>
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<td>SID 136904369 - External ID: PubChem6479</td>
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<td>Chembase.cn</td>
<td>SID 162231867 - External ID: 137605</td>
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<td>SID 125341545 - External ID: 888-880-674</td>
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<td>SID 126532500 - External ID: 1498-40-4</td>
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<td>SID 126609408 - External ID: 1030988</td>
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<td>SID 87246095 - External ID: I14-4221</td>
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<td></td>
<td>SID 24860432 - External ID: 336858_ALDRICH</td>
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**Ethylphosphinyl difluoride (430-78-4)**

No further information.

**Ethylphosphonyl dichloride (1066-50-8)**

<table>
<thead>
<tr>
<th>Also known as:</th>
<th>1066-50-8</th>
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<tbody>
<tr>
<td></td>
<td>1-dichlorophosphorylethane</td>
</tr>
<tr>
<td></td>
<td>Phosphonic dichloride</td>
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<tr>
<td></td>
<td>Ethyl-</td>
</tr>
<tr>
<td>EINECS 213-918-3</td>
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</tr>
<tr>
<td>Ethyldichlorophosphite</td>
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</tr>
<tr>
<td>BRN 1743286</td>
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</tr>
<tr>
<td>ACMC-20akvx</td>
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<table>
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<tr>
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<tr>
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<td>ABI Chem</td>
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<td>Achemica</td>
<td>SID 162304905 - External ID: ACMC-20akvx</td>
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<td>Angene Chemical</td>
<td>SID 136402034 - External ID: AG-D-21227</td>
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<td>Chembase.cn</td>
<td>SID 162241707 - External ID: 147519</td>
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<td>SID 3152756 - External ID: sGQLLHb^BbLbdMM@@</td>
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<td>ChemFrog</td>
<td>SID 125796454 - External ID: 888-951-312</td>
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<td>SID 125809479 - External ID: 888-976-331</td>
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</table>
**Ethylphosphonyl difluoride (753-98-0)**

<table>
<thead>
<tr>
<th>Also known as</th>
<th>Molecular Formula: C2H5F2OP (<a href="http://pubchem.ncbi.nlm.nih.gov">http://pubchem.ncbi.nlm.nih.gov</a>)</th>
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</thead>
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<td>E-DF</td>
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<tr>
<td>Ethylphosphonic difluoride</td>
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<tr>
<td>Ethylphosphonyl difluoride</td>
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<tr>
<td>Phosphonic difluoride</td>
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<tr>
<td>ethyl-, CTK2G9070</td>
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</table>

**HN1: Bis(2-chloroethyl)ethylamine (538-07-8)**

<table>
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<tr>
<th>Also known as</th>
<th>Molecular Formula: C6H13Cl2N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen mustard</td>
<td></td>
</tr>
<tr>
<td>HN1, 2-Chloro-N-(2-chloroethyl)-N-ethylethanamine</td>
<td></td>
</tr>
<tr>
<td>2,2′-Dichlorotriethylamine</td>
<td></td>
</tr>
<tr>
<td>Ethylbis(2-chloroethyl)amine</td>
<td></td>
</tr>
<tr>
<td>Ethyl-S, AI3-16200</td>
<td></td>
</tr>
<tr>
<td>Triethylamine 2,2′-dichloro-</td>
<td></td>
</tr>
</tbody>
</table>

**HN2: Bis(2-chloroethyl)methylamine (51-75-2)**

<table>
<thead>
<tr>
<th>Also known as</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechlorethamine; Bis(beta-chloroethyl)methylamine</td>
<td></td>
</tr>
<tr>
<td>N,N-Bis(2-chloroethyl)methylamine</td>
<td></td>
</tr>
<tr>
<td>Bis(2-chloroethyl)methylamine</td>
<td></td>
</tr>
<tr>
<td>Caryolysine; Chloramine (the Nitrogen Mustard)</td>
<td></td>
</tr>
<tr>
<td>Chlorethazine; Chlormethine</td>
<td></td>
</tr>
<tr>
<td>2-Chloro-N-(2-chloroethyl)-N-methylethanamine</td>
<td></td>
</tr>
<tr>
<td>Dichlor Amine; Dichloren (German)</td>
<td></td>
</tr>
<tr>
<td>Beta,beta′-Dichlorodiethyl-N-methylamine</td>
<td></td>
</tr>
<tr>
<td>Di(chloroethyl)methylamine</td>
<td></td>
</tr>
<tr>
<td>N,N-Di(chloroethyl)methylamine</td>
<td></td>
</tr>
<tr>
<td>Di(2-chloroethyl)methylamine</td>
<td></td>
</tr>
<tr>
<td>2,2′-Dichloro-N-methylidithylamine</td>
<td></td>
</tr>
<tr>
<td>Diethylamine, 2,2′-dichloro-N-methyl-</td>
<td></td>
</tr>
</tbody>
</table>
Embichin
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-methyl-
HN2; HN-2; N-Methyl-Lost (German)
N-Methyl-bis-chloraethylamin (German)
Methylbis(chloroethylamine)
Methylbis(beta-chloroethyl)amine
N-Methylbis(beta-chloroethyl)amine
N-Methylbis(2-chloroethyl)amine
Methylbis(2-chloroethyl)amine
N-Methyl-2,2’-dichlorodiethylamine
Methylidi(2-chloroethyl)amine
Mustargen
Mustine
Nitrogen mustard
Stickstofflost (ebewe)

Molecular Formula: C5H11Cl2N
Description: Colorless to pale yellow, oily liquid with a faint soapy odor or fruity odor at high concentrations

Manufacturers: Mechorethamine is not manufactured in commercial quantities in the US.
(http://toxnet.nlm.nih.gov)

Storage Conditions: Carcinogens should be kept in only one section of cupboard, an explosion-proof refrigerator or freezer.

Shipment Methods and Regulations:
To avoid spilling, carcinogens should be transported in securely sealed glass bottles or ampoules, which should themselves be placed inside strong screw-cap or snap-top container that will not open when dropped and will resist attack from the carcinogen. The carcinogen should be enclosed in a securely sealed, watertight container (primary container), which should be enclosed in a second, unbreakable, leak proof container that will withstand chem attack from the carcinogen (secondary container). The space between primary and secondary container should be filled with absorbent material, which would withstand chem attack from the carcinogen and is sufficient to absorb the entire contents of the primary container in the event of breakage or leakage. Each secondary container should then be enclosed in a strong outer box. The space between the secondary container and the outer box should be filled with an appropriate quantity of shock-absorbent material.

HN3: Tris(2-chloroethyl)amine (555-77-1)

Also known as: Agent HN3
A13-16198
2-Chloro-N,N-bis(2-chloroethyl)ethanamine
Ethanamine, 2-chloro-N,N-bis(2-chloroethyl)-HN 3; 2,2',2"-trichlorotriethylamine
Triethylamine, 2,2',2"-trichloro-
Tris(beta-chloroethyl)amine
TS 160
Trichlormethine
Trimustine

Molecular Formula: C6H12Cl3N
Description: Colorless to pale yellow, oily liquid with a faint butter almond odor; Mobile liquid with a faint odor of fish and soap

Manufacturers: The nitrogen mustards (including tris(2-chloroethyl)amine) are not manufactured in significant commercial quantities in the United States (https://toxnet.nlm.nih.gov)

Hydrogen cyanide (74-90-8)

Also known as: Formonitrile; Hydrocyanic acid; Prussic acid; Formic anammonide; Carbon hydride nitride, HCN

Molecular Formula: CHN
Description: Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor; Water-white liquid below 26.5°C (acid)


Degussa Corp., 379 Interpace Pkwy., P.O. Box 677, Parsippany, NJ 07054-0677, (973) 541-8000; Production site: Theodore, AL 36590

The Dow Chemical Co., 2030 Dow Center, Midland, MI 48642, (989) 636-1000; Production site: Freeport, TX 77541

DuPont Coatings & Color Technologies; DuPont Performance Coatings; Production site: Memphis, TN 38118

E.I. DuPont de Nemours and Co., 1007 Market St., Wilmington, DE 19898, (302) 774-1000
DuPont Safety & Protection, DuPont Chemical Solutions Enterprise, Customer Service Center, BMP 23, Wilmington, DE 19899, (302) 892-8254; Production site: Beaumont, TX 77704

INEOS Americas, LLC Central Park of Lisle, 4225 Naperville Rd., Suite 600, Lisle, IL 60532, (630) 957-7000; Production sites: Green Lake, TX 77031; Lima, OH 45804

INVISTA, Inc., INVISTA Building, 4123 East 37th St. North, Wichita, KS 67220, (316) 828-1000

INVISTA Specialty Intermediates, Three Little Falls Centre, 2801 Centerville Rd., Wilmington, DE 19808, (800) 231-0998; Production sites: Orange, TX 77631; Victoria, TX 77901

Kemira Water Solutions, Inc., 808 East Main St., Lakeland, FL 33801, (863) 533-5990; Production site: Waggaman, LA 70094

Rohm and Haas Co., 100 Independence Mall West, Philadelphia, PA 19106-2399, (215) 592-3000; Performance Polymers Business; Production site: Deer Park, TX 77536

Solutia, Inc., 575 Maryville Centre Dr., St. Louis, MO 63141, (314) 674-1000; Production site: Alvin, TX 77512

Syngenta Crop Protection, 410 Swing Rd., Greensboro, NC 27409, (336) 632-6000; Production site: St. Gabriel, LA 70776

(http://toxnet.nlm.nih.gov)


Shipment Methods and Regulations: Hydrocyanic acid aqueous solution (<5% HCN) requires a shipping label of: "Corrosive, Poison." It falls in DOT Hazard Class 6.1 and Packing Group II. Passenger aircraft or railcar/shipment/ is forbidden and the limit on cargo aircraft shipment is limited. Shipments of solutions from 5–20% is forbidden. Stabilized, anhydrous HCN requires a shipping label of: "Poison, Flammable Liquid." Passenger aircraft or railcar shipment is forbidden and cargo aircraft shipment is forbidden as well.

Packaging and Labeling: Marine pollutant.

F+ symbol
T+ symbol
N symbol
R: 12-26-50/53
S: 1/2-7/9-16-36/37-38-45-60-61
UN Sanctions on Iran and North Korea

UN Hazard Class: 6.1
UN Subsidiary Risks: 3
UN Packing Group: I

Hydrogen fluoride (7664-39-3)

Also known as: Acide hydrofluore [French]
Acido fluorhidrico [Spanish]
Acidofluoridrico [Italian]
Caswell no 484
EPA Pesticide Chemical Code 045601
Fluorhydric acid; fluorowodor [Polish]
Fluorure d’hydrogene anhydre [French]
Fluoruro de hidrogeno anhidro [Spanish]
Fluorwasserstoff [German]
Fluorwaterstof [Dutch]
Etching Acid; HFA
Fluorohydric acid
Fluoric acid
Antisal 2B
Deuteriumfluoride
Aqueous hydrogen fluoride

Molecular Formula: HF
Description: Colorless gas or fuming liquid (below 67°F) with a strong, irritating odor.

Manufacturers: E.I. du Pont de Nemours and Company, 1007 Market St, Wilmington, DE 19898, (302) 774-1000
DuPont Coatings & Color Technologies; DuPunt Performance Coatings;
Production site: La Porte, Texas 77571

/Hydrofluoric acid/
Honeywell International, Inc., 101 Columbia Road, P.O. Box 4000, Morristown, NJ 07962-1057, (973)455-2000

Speciality Chemicals; Production site: Geismar, Louisiana 70734
(http://toxnet.nlm.nih.gov)

Storage Conditions: Keep in plastic, lead, wax, or paraffin paper bottles

Shipment Methods and Regulations:
Hydrogen fluoride, anhydrous requires a shipping label of: “Corrosive, Poison.” It falls in DOT Hazard Class 8 and Packing Group I. Passenger aircraft or railcar
shipment is forbidden and cargo aircraft shipment is forbidden as well.

Hydrofluoric acid solution (below 60%) requires a shipping label of: "Corrosive,
Poison." It falls in DOT Hazard Class 8 and Packing Group II. Hydrofluoric acid
solution (stronger than 60%) requires a shipping label of: "Corrosive, Poison." It
falls in DOT Hazard Class 8 and Packing Group I.

Packaging and Labeling: T+ symbol
C symbol
R: 26/27/28-35
S: 1/2-7/9-26-36/37/39-45
UN Hazard Class: 8
UN Subsidiary Risks: 6.1
UN Packing Group: I

Lewisite 1: 2-Chlorovinylidichloroarsine (541-25-3)

Also known as: Arsine, dichloro(2-chlorovinyl)-
Arsonous dichloride, (2-chloroethenyl)-
1-Chloro-2-di-chloroarsinoethane
(2-Chloroethenyl)arsonous dichloride
Chlorovinylarsinedichloride
beta-Chlorovinylbichloroarsine
Chlorovinyl dichloroarsine
beta-Chlorovinylidichloroarsine
2-Chlorovinylidichloroarsine
Dichloro(2-chlorovinyl)arsine
Lewisite

Molecular Formula: C2H2AsCl3

Description: Pure colorless odorless liquid. Impurities lead to colors ranging from violet to
brown. When impure, it is brown with an odor like geraniums.

Storage Conditions: Store in tightly closed containers in a cool, well vented area away from alkalis.

Shipment Methods and Regulations:
This compound requires a shipping label of "Poison." It falls into DOT Hazard
Class 6.1 and Packing Group: I.

Packaging and Labeling: Shipping Name/Number DOT/UN/NA/IMO:
UN 2810; L (Lewisite)
IMO 6.1; Arsenic cmpd, liquid or solid, not otherwise specified
Standard Transportation Number:
49 205 17; Lewisite
<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Molecular Formula</th>
<th>Description</th>
<th>Manufacturers</th>
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<tbody>
<tr>
<td><strong>Lewisite 2: Bis(2-chlorovinyl)chloroarsine (40334-69-8)</strong></td>
<td>C$<em>5$H$</em>{13}$NO$_2$</td>
<td>Colorless liquid. Amine-like odor.</td>
<td>The Dow Chemical Company, 2030 Dow Center, Midland, MI 47642, (989) 636-1000; Production site: South Charleston, WV 25303</td>
</tr>
<tr>
<td>Also known as:</td>
<td>Lewisite (L-2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bis(2-chlorovinyl)chloroarsine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dichlorovinylarsine chloride</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARSINE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIS(2-CHLOROVINYL)CHLORO-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lewisite 3: Tris(2-chlorovinyl)arsine (40334-70-1)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Also known as:</td>
<td>Lewisite III</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lewisite (L-3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tris(2-chlorovinyl)arsine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsine, tris(2-chloroethenyl)-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Methyl benzilate (76-89-1)</strong></td>
<td>C$<em>5$H$</em>{12}$O$_2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Also known as:</td>
<td>Methyl diphenylglycolate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzilic acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>methyl ester</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzeneacetic acid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>methyl ester</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Methyldiethanolamine (105-59-9)</strong></td>
<td>C$<em>6$H$</em>{14}$NO$_2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Also known as:</td>
<td>N-Methyl diethanolamine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,2'-(Methylimino)diethanol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-(N-2-Hydroxyethyl-N-methylamino)ethanol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bis(2-hydroxyethyl)methylamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethanol, 2,2'-(methylimino)bis-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylbis(2-hydroxyethyl)amine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N,N-Bis(2-hydroxyethyl)methylamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N,N-Di(2-hydroxyethyl)-N-methylamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methyl-2,2'-iminodioethanol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methylaminodiglycol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methyliminodiethanol</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Methylphosphinyl dichloride (676-83-5)

Also known as: Dichloromethylphosphine  
Methyldichlorophosphine  
Methylphosphonous dichloride  
Methylphosphorus dichloride  
Phosphine, dichloromethyl-  
Methanephosphonyl chloride  
Phosphonic dichloride, methyl-  
Methylphosphonyl dichloride

Molecular Formula: CH3Cl2P  
Description: Colorless liquid with a pungent odor  

Manufacturers: Specialty Organics Inc., 5263 North Fourth St., Irwindale, CA 91706, (818) 962-2008  
(\text{http://toxnet.nlm.nih.gov})

Storage Conditions: Store in tightly closed containers in a cool, well ventilated area. Sources of ignition such as smoking and open flames are prohibited where this chemical is handled, used, or stored.

Packaging and Labeling: Shipping Name/Number DOT/UN/NA/IMO: NA 9206; Methylphosphonic dichloride  
(\text{http://toxnet.nlm.nih.gov})

Methylphosphinyl difluoride (753-59-3)

No further information.
### Methylphosphonic acid (993-13-5)

<table>
<thead>
<tr>
<th>Also known as</th>
<th>Methyl phosphonic acid; Methylphosphonate; Methanephosphonic acid; Phosphonic acid, methyl-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Formula</td>
<td>CH$_5$O$_3$P</td>
</tr>
<tr>
<td>Description</td>
<td>White solid; White flakes or crystalline solid (<a href="http://hazmap.nlm.nih.gov">http://hazmap.nlm.nih.gov</a>)</td>
</tr>
</tbody>
</table>
| Chemical Vendors | ABI Chemicals  
Achemica  
Alfa Aesar  
Apexmol  
Arking Pharma  
Chembo Pharma  
Finetech Industry  
J and K Scientific  
Manchester Organics  
Merck Millipore  
Molport  
Santa Cruz Biotechnology  
Sigma-Aldrich |
| Storage Conditions | Store in a cool, dry, well-ventilated area. Store away from incompatible materials and foodstuff containers; Lined metal can, Lined metal pail/drum; Plastic pail; Polyliner drum |
| Packaging and Labeling | UN/ID number: 3261 Class 8, Packing group II ([http://www.scbt.com](http://www.scbt.com)) |

### Methylphosphonothioic dichloride (676-98-2)

| Also known as | Methylthiophosphonic dichloride  
AC1L1UQ9, dichloro-methyl-sulfanylidene-Methyl phosphonothioic dichloride |
| Chemical Vendors | AOKChem  
Chembo Pharma  
Conier Chem  
eNovation Chemicals  
Molport  
WATSON INTERNATIONAL LTD  
ABI Chem  
AKos Consulting & Solutions  
Angene Chemical |
Methylphosphonyl dichloride (DC) (676-97-1)

<table>
<thead>
<tr>
<th>Also known as</th>
<th>Methylphosphonic dichloride</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Methanephosphonyl chloride</td>
</tr>
<tr>
<td></td>
<td>Methylphosphonyl dichloride</td>
</tr>
<tr>
<td></td>
<td>Phosphonic dichloride</td>
</tr>
<tr>
<td></td>
<td>methyl-</td>
</tr>
</tbody>
</table>

**Molecular Formula:** CH₃Cl₂OP

**Description:** Low melting solid, Pungent odor, Colorless liquid

**Chemical Vendors:**
- AEchem Scientific
- AKos
- Alfa Aesar
- Alfa Chemistry
- Chembo Pharma
- Conier Chem
- Enamine
- Finetech Industry
- Jalor-Chem
- LeadGen Labs
- Molport
- Rosewachem
- Rosewell Industry Co.
- Ryan Scientific
- Shanghai IS Chemical Technology
- Sigma-Aldrich
- Tokyo Chemical Industry Ltd
- Trylead Chemical
- UkrOrgSynthesis

**Manufacturers:** Specialty Organics Inc., 5263 North Fourth St., Irwindale, CA 91706, (818) 962-2008

**Storage Conditions:** Store in tightly closed containers in a cool, well ventilated area.

Methylphosphonyl difluoride (DF) (676-99-3)

<table>
<thead>
<tr>
<th>Also known as</th>
<th>Difluoro</th>
</tr>
</thead>
</table>
Methylphosphonyldifluoride
Methyl difluorophosphite
Methylphosphonicdifluorid
Methylphosphonyl difluoride

Molecular Formula: CH₃F₂OP
Description: Liquid with a pungent acrid odor

Chemical Vendors: AAA Chemistry
ABI Chem
Chembase.cn
ChemFrog

Mustard gas: Bis(2-chloroethyl)sulfide (505-60-2)

Also known as: Sulfur mustard
Yperite
Senfgas
Iprit
Lost
Yellow cross liquid
Bis(2-chloroethyl) sulfide
Schwefel-lost
Mustard
Sulfur

Molecular Formula: C₄H₈Cl₂S
Description: Oily yellow-brown liquid with garlic taste and mustard odor

Chemical Vendors: ABI Chem
AKos Consulting & Solutions
Amadis Chemical
Angene Chemical
Chembase.cn
ChemFrog

Storage Conditions: Store in tightly closed containers in a cool, well vented area away from oxidizers. here possible, automatically pump liquid from drums or other storage containers to process containers.

Packaging and Labeling: UN Hazard Class: 6.1
UN Packing Group: I

N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-ols and corresponding protonated salts*
No further information.

**N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-thiols and corresponding protonated salts**

No further information.

**N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethyl-2-chlorides and corresponding protonated salts**

No further information.

**N,N-Dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidic dihalides**

No further information.

**N,N-Diisopropyl-(beta)-aminoethane thiol (5842-07-9)**

Also known as: 2-(Diisopropylamino)ethanethiol
Ethanethiol
2-(diisopropylamino)-
Molecular Formula: C8H19NS
Chemical Vendors: AAA Chemistry
ABI Chem
AKos Consulting & Solutions
Angene Chemical
Angene International
Chembase.cn
ChemExper Chemical Directory
ChemFrog
Finetech Industry Limited
Chemical Vendors: ABI Chemicals

**N,N-Diisopropyl-(beta)-amino-ethanol (96-80-0)**

Also known as: 2-(Diisopropylamino)ethanol
(Diisopropylamino)ethanol
N,N-Diisopropylethanolamine
N,N-Diisopropyl ethanolamine
Molecular Formula: C8H19NO
Description: Colorless to slightly yellow liquid
Chemical Vendors: ABI Chemicals
UN Sanctions on Iran and North Korea

Alfa Chemistry
Angene
AOKChem
Ark Pharm, Inc.
ASDI
BePharm
Bide Pharmatech
ChemPacific
Conier Chem
eNovation Chemicals
Finetech Industry
InterBioScreen
Jalor-Chem
King Scientific
Labseeker
Letopharm
Molport
MP Biomedicals
OXchem
Pharmpete
Princeton Biomolecular
Shanghai IS Chemical Technology
Sigma-Aldrich
Timtec
Tokyo Chemical Industry Ltd
Tractus Company Limited
Vitas-M
Zerenex Molecular
(http://www.chemspider.com)

N,N-Diisopropyl-(beta)-aminoethyl chloride (96-79-7)

Also known as: 1-Chloro-2-diisopropylaminoethane
N-(2-Chloroethyl)diisopropylamine
2-Chloro-N,N-diisopropylethanamine
2-Chloro-N,N-diisopropylethylamine

Molecular Formula: C8H18ClN

Chemical Vendors: ABI Chemicals
AKos
ASDI
eNovation Chemicals
Innovapharm B
N,N-Diisopropyl-2-aminoethyl chloride hydrochloride (4261-68-1)

| Also known as: | 2-Diisopropylaminoethyl Chloride Hydrochloride  
|               | Chloroethyl-diisopropylammonium chloride |
| Molecular Formula: | C8H19Cl2N  
| Chemical Vendors: | Abblis Chemicals  
|                   | ABI Chemicals  
|                   | Achemica  
|                   | Alfa Aesar  
|                   | AOKChem  
|                   | Apexmol  
|                   | Apollo Scientific Limited  
|                   | Chembo Pharma  
|                   | Conier Chem  
|                   | eNovation Chemicals  
|                   | Finetech Industry  
|                   | Jalor-Chem  
|                   | Merck Millipore  
|                   | Molport  
|                   | MP Biomedicals  
|                   | Pharment  
|                   | Shanghai IS Chemical Technology  
|                   | Sigma-Aldrich  
|                   | Tokyo Chemical Industry Ltd  
|                   | Trylead Chemical  
|                   | Zylexa Pharma  
| [http://www.chemspider.com](http://www.chemspider.com) |

N,N-Dimethylaminophosphoryl dichloride (677-43-0)

| Also known as: | Dichlorophosphoric dimethylamide |
DMPADC
(Dimethylamido)phosphoric dichloride
N,N-Dimethylphosphoramidodichloridate

Molecular Formula: C2H6Cl2NOP

Chemical Vendors: ABI Chemicals
Alfa Aesar
eNovation Chemicals
Molport
Santa Cruz Biotechnology
Sigma-Aldrich
Tokyo Chemical Industry Ltd
Trylead Chemical
Zerenex Molecular
Zylexa Pharma
Akos Consulting & Solutions
Chembase.cn
Angene Chemical
Hangzhou Trylead Chemical Technology
TCI (Tokyo Chemical Industry)

O-Alkyl (<C10, incl. cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr)-phosphonofluoridates (Sarin: O-Isopropyl methylphosphonofluoridate (107-44-8) Soman: O-Pinacolyl methylphosphonofluoridate (96-64-0))

No further information.

O-Alkyl (<C10, incl. cycloalkyl) N,N-dialkyl (Me, Et, n-Pr or i-Pr) Phosphoramidocyanidates

No further information.

O-Alkyl (H or <C10, incl. cycloalkyl) O-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonites and corresponding alkylated or protonated salts

No further information.

O-Alkyl (H or <C10, incl. cycloalkyl) S-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonothiolates and corresponding alkylated or protonated salts

No further information.

O-Ethyl 2-diisopropylaminoethyl methylphosphonite (QL) (57856-11-8)
Also known as: Methylphosphonic acid (2-(bis(1-methylethyl)amino)ethyl) ethyl ester
O-Ethyl-O’-(2-diisopropylaminoethyl)methylphosphonate
Agent QL

Molecular Formula: C11H26NO2P
Description: Colorless liquid, strong fishy odor

Chemical Vendors:
ABI Chemicals
(http://www.chemspider.com)

O-Mustard: Bis(2-chloroethylthioethyl)ether (63918-89-8)

Also known as: Bis(2-chloroethylthioethyl) ether
Agent T
O-Mustard T
Bis(beta-chloroethylthioethyl) ether


Chemical Vendors:
ABI Chem
Angene Chemicals
ChemFrog

PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8)

Also known as: Octafluoroisobutylene
PFIB, Octafluoro-sec-butene
Isobutene
Octafluoro-
Octafluoroisobutene
PFIB
Perfluoroisobutylene

Molecular Formula: C4F8
Description: Colorless gas; [ICSC] Colorless gas that is a colorless liquid when stored under its

Chemical Vendors:
ABI Chem
Angene Chemicals
Chembase.cn
ChemFrog
Chemical Synthesis Database
Molport
SynQuest
Zylexa Pharma
**Phosgene: Carbonyl dichloride (75-44-5)**

<table>
<thead>
<tr>
<th>Also known as:</th>
<th>Carbolic dichloride</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carbonyl dichloride</td>
</tr>
<tr>
<td></td>
<td>Carbonyl chloride</td>
</tr>
<tr>
<td></td>
<td>Carbon oxychloride</td>
</tr>
<tr>
<td></td>
<td>Chloroformyl chloride</td>
</tr>
<tr>
<td></td>
<td>Phosgen</td>
</tr>
<tr>
<td></td>
<td>Carbon dichloride oxide</td>
</tr>
</tbody>
</table>

**Molecular Formula:** \( \text{CCl}_2\text{O} \)


**Chemical Vendors:**
- ABI Chem
- AKos Consulting & Solutions
- Angene Chemical
- Angene International
- Chembase.cn
- ChemFrog
- ChemMol
- Finetech Industry Limited
- IS Chemical Technology
- Sigma-Aldrich
- Molport
- Alfa Chemistry
- AOKChem
- Jalor-Chem
- Otava Chemicals
- Shanghai IS Chemical Technology

**Manufacturers:**
- BASF Corporation, Plastics and Fibers Division, 3000 Continental Drive North, Mount Olive, NJ 07828-1234, (973)426-2600; Polyurethanes, PO Box 457, Geismar, LA 70734; Production site: Geismar, LA 70734

- Bayer Crop Science, 2 T.W. Alexander Drive, Research Triangle Park, NC 27709, (919)549-2000; Crop Protection, 8400 Hawthorn Road, P.O. Box 4913, Kansas City, MO 64120, (816)242-2000; Production site: Institute, WV 25112

- Bayer Material Science LLC, 100 Bayer Road, Pittsburgh, PA 15205-9741, (800)662-2927; Production sites: Baytown, TX 77521; New Martinsville, WV 26155
The Dow Chemical Company, 2030 Dow Center, Midland, MI 48642, (989)636-1000; Production site: Freeport, TX 77541

E.I. du Pont de Nemours and Company, DuPont Coatings and Color Technologies, 1007 Market Street, Wilmington, DE 19898, (302)774-1000; DuPont Performance Coatings, Route 130 Canal Road, Deepwater, NJ 08023; Production site: Deepwater, NJ 08023

General Electric Company, GE Industrial, 3135 Easton Turnpike, Fairfield, CT 06828, (203)373-2211; GE Plastics, 1 Plastics Ave, Pittsfield, MA 01201, (413)448-7110; Production sites: Burkville, AL 36752; Mount Vernon, IN 47620

Huntsman International LLC, 500 Huntsman Way, Salt Lake City, UT 84108, (801)584-5700; Huntsman Polyurethanes, 9156 Highway 75, P.O. Box 517, Geismar, LA 70734, (225)673-6141; Production site: Geismar, LA 70734

Isochem Inc., One North Transit Road, Lockport, NY 14094, (716)433-6764; Production site: Lockport, NY 14094

PPG Industries, Inc., Chemicals Group, One PPG Place, Pittsburgh, PA 15272, (412)434-3131; Fine Chemicals, 440 College Park Drive, Monroeville, PA 15146, (412)434-3131; Production sites: Barberton, OH 44203; La Porte, TX 77571

Syngenta Crop Protection, 410 Swing Road, Greensboro, NC 27409, (336)632-6000; Production site: Cold Creek, AL 36512

Twin Lake Chemicals Inc., 520 Mill Street, P.O. Box 411, Lockport, NY 14094, (716)433-3824; Production site: Lockport, NY 14094

Storage Conditions: Store in tightly closed, steel containers.
Packaging and Labeling: Note: 5

T+ symbol
R: 26-34
S: 1/2-9-26-36/37/39-45
UN Hazard Class: 2.3
UN Subsidiary Risks: 8

Phosphorus oxychloride (10025-87-3)

Also known as: Phosphoryl chloride
Phosphoric trichloride
Phosphoryl trichloride
10025-87-3
Phosphoroxychloride
Trichlorophosphine oxide

Molecular Formula: Cl3OP

Description: Clear, colorless to yellow, oily liquid with a pungent and musty odor

Chemical Vendors: ABBLIS Chemicals
ABI Chem
AKos Consulting & Solutions
Ambinter
Angene Chemical
Angene International
Chembase.cn
ChemFrog
ChemMol
Finetech Industry Limited
IS Chemical Technology
Sigma-Aldrich
Alfa Aesar
Chembo Pharma
ChemPacific
Conier Chem
eNovation Chemicals
Fluorochem
Merck Millipore
Molport
Ryan Scientific
Zerenex Molecular

Manufacturers: Rhodia Inc, 8 Cedar Brook Dr, Cranbury, NJ 08512, (609) 860-4000; Consumer Specialties Division; Production site: Charleston, SC 29405

Supresta US, 420 Saw Mill River Rd, Ardsley Park, Ardsley, NY 10502, (914) 269-5900; Production site: Gallipolis Ferry, WV 25515

Storage Conditions: Phosphorus oxychloride is stored and shipped in 3.8 L (1-gal) or smaller glass containers and DOT-specification wooden over packing. Bulk POCl3 shipments are in nickel-clad tank cars of 15,000–30,000 L (4000–8000 gal) each. Glass and glass-lined steel equipment frequently is used for storage, as well as for reaction vessels.

Packaging and Labeling: T+ symbol
C symbol
Phosphorus pentachloride (10026-13-8)

Also known as: Phosphorus(V) chloride
Pentachlorophosphorane
10026-13-8
PCl5
Phosphorane
Pentachloro-phosphoric chloride
Phosphoric perchloride

Molecular Formula: Cl5P

Description: Greenish-yellow crystalline solid with an irritating odor, Tetragonal crystals

Chemical Vendors: ABI Chemicals
Achemica
Alfa Aesar
Alfa Chemistry
Amadis Chemical
Angene
Apollo Scientific Limited
BePharm
ChemPacific
Conier Chem
Flurochem
Jalor-Chem
King Scientific
Merck Millipore
Molport
Ryan Scientific
Shanghai IS Chemical Technology
Sigma-Aldrich
Tokyo Chemical Industry Ltd
Tractus Company Limited
Zerenex Molecular
ChemFrog
ChemMol
Fintech Industry Limited
Manufacturers: Twin Lake Chemicals, 520 Mill Street, PO Box 411, Lockport, NY 14095, (716) 433-3824; Production site: Lockport, NY 14094

Storage Conditions: Store in a glass bottle with a ground glass stopper.

Packaging and Labeling: T+ symbol
R: 14-22-26-34-48/20
S: 1/2-7/8-26-36/37/39-45
UN Hazard Class: 8

Phosphorus pentasulphide (1314-80-3)

Also known as: Sulfur phosphide
Phosphoric sulfide
Phosphorus persulfide
Thiophosphoric anhydride
Diphosphorus pentasulfide
Diposphorus pentasulphide

Molecular Formula: P4S10


Chemical Vendors: ChemPacific
Molport
Sigma-Aldrich
Tractus Company Limited
Zerenex Molecular
ABI Chem
AKos Consulting & Solutions
Angene Chemical
ChemMol

Manufacturers: Chemtrade Phosphorous Specialties LLC, 440 N. 9th Street, Lawrence, KS 66044, (877) 902-3830; Production site: Lawrence, KS 66044

Solutia Inc., 575 Maryville Centre Drive, St. Louis, MO 63141, (314) 674-1000; Production site: Sauget, IL 62206

Anshul Chemicals Ltd., Excel Estate, S.V. Rd., Goregaon (West), Mumbai (Bombay), Maharashtra, India 400 062, 91-22-872 4091/ 872 4091/872 0854; Production site: Roha, Maharashtra
Astaris, LLC, Creve Coeur IV, 622 Emerson Road, St. Louis, MO 63141, (314) 983-7500; Production site: Lawrence, KS

Cheminova A/S, Postboks 9, Lemvig, Ringkobing, Denmark DK-7620, +45 96 90 96 90; Production site: Lemvig, Ringkobing

Excel Industries Ltd., 184-87, Swami Vivekanand Road, Jogeshwari (W), Mumbai (Bombay), Maharashtra, India 400 102, 91-22-678 8278/ 678 3537; Production site: Mumbai (Bombay), Maharashtra

Fosfoquim S.A., Chile; Production site: Padre Hurtado, Region Metropolitana de Santiago

Fujian Sannong Chemistry Co., Ltd., No. 18-29 North of Liedong Street, Sanming, Fujian Province, China 365000, 86-598-8221401; Production site: Sanming, Fujian Province

Guiyang Tri-Phosphorus Chemicals (Group) Co., Ltd., No. 43, Waihuancheng East Road, Guiyang, Guizhou Province, China 550002, 86-851-5933076; Production site: Guiyang, Guizhou Province

Italmatch Chemicals S.p.A., Via Pietro Chiesa 7/13, Torri Piane-San Benigno, Genova (GE), Liguria, Italy I-16149, +39 (010) 64 208 1; Production site: Spoleto (PG), Umbria

Jiangxi Zhangshu Chemical Factory, No. 89 North Yaodu Ave., Zhangshu, Jiangxi Province, China 331201, 86-795-7332151; Production site: Zhangshu, Jiangxi Province

Jinhua Chemical Industry Co., Jinhua, Zhejiang Province, China 321016, 86-579-2323010 / 2342975; Production site: Jinhua, Zhejiang Province

Liaoyang Chemical Plant, No. 50 Zhenxing Road, Baita District, Liaoyang, Liaoning Province, China 111004, 86-419-3132671 / 3302671; Production site: Liaoyang, Liaoning Province

Star Chemicals (Bombay) Ltd., 55/58, Jolly Maker Chambers No. 2, 5th Fl., Nariman Point, Mumbai (Bombay), Maharashtra, India 400 021, 91-22-287 0165; Production site: Navi Mumbai (New Bombay), Maharashtra

Tekchem, S.A. de C.V., Av. Jalisco No. 180, P. 5, Col. Tacubaya, Del. Miguel Hidalgo, Mexico, Distrito Federal, Mexico 11870, (5255) 5272-2221 / 2171; Production Site: Salamanca, Guanajuato
Thermphos Deutschland GmbH, Phosphor Derivate, B 797, Industriepark Hoechst, Frankfurt am Main, Hessen, Germany D-65926, +49 (69) 305 3707; Production site: Frankfurt am Main, Hessen

Tongling Chemical Industry Group Co., No. 42 North Huaihe Road, Tongling, Anhui Province, China 244000, 86-562-2861056 / 2863345; Production site: Tongling, Anhui Province

United Phosphorous Ltd., 11, GIDC Industrial Estate, Vapit, Bulsar Dist., Gujarat, India 396 155, 91-22-493 0681 / 0560; Production site: Ankleshwar, Gujarat

Yunnan Diandong Phosphate Chemicals Corp., Chengnan, Xuanwei, Yunnan Province, China 655400, 86-874-7132199 / 7123456 / 7123558; Production site: Xuanwei, Yunnan Province

Zhangjiakou City Chemical Industrial Material Plant, No. 9 Jianshexijie, Qiaoxi District, Zhangjiakou, Hebei Province, China 75000, 86-313-2017541 / 2014130; Production site: Zhangjiakou, Hebei Province

Albright & Wilson, P.O. Box 80, Trinity Street, B69 4LN Oldbury, Warley, West Midlands, United Kingdom 021 541 3283

Albright & Wilson Ltd., P.O. Box 3, Oldbury, B68 0NN Warley, United Kingdom (+44) 21 4294942

Alfa Aesar, A Johnson Matthey Company, 26 Parkridge Road, Ward Hill, MA 01835, (978) 521-6328 /Formulator/

Atochem, 4, Cours Michelet, 92080 Paris la Defense, France

Celanese GmbH, Industriepark Hochst, 65926 Frankfurt am Main, Germany

Chemie AG Bitterfeld-Wolfen, Postfach 1139, 06733 Bitterfeld, Germany, 0049/3493 72724

Cheminova Agro A/S, Thybороoenvej 78, 7673 Harboore, Denmark 45 97 83 41 00

Hoechst AG, Postfach 80 03 20 Bruningstrasse 50, 65903 Frankfurt am Main, Germany
Italmatch s.r.l., Via de Medici, 17, 20013 Magenta, Italy 02/97234219

Noah Technologies Corp., Noah Chemical Div, 1 Noah Park, San Antonio, TX 78249, (210) 691-2000

Omya Peralta GmbH, Wandsbeker Zollstr. 13, 22041 Hamburg, Germany +49-40-65872-0


Packaging and Labeling: F symbol
Xn symbol
N symbol
R: 11-20/22-29-50
S: 2-61
UN Hazard Class: 4.3
UN Subsidiary Risks: 4.1
UN Packing Group: II (http://www.cdc.gov/niosh)

Phosphorus trichloride (7719-12-2)

Also known as: Phosphorus chloride
Phosphorous trichloride
Trichlorophosphine
Phosphorus(III) chloride
Trichlorophosphane
Phosphorous chloride

Molecular Formula: Cl3P


Chemical Vendors: ABI Chem
AKos Consulting & Solutions
Angene Chemical
Angene International
Chembase.cn
ChemMol
IS Chemical Technology
Sigma-Aldrich
TCI (Tokyo Chemical Industry)

Manufacturers: Monsanto Company, 800 North Lindbergh Boulevard, St. Louis, MO 63167,
UN Sanctions on Iran and North Korea

(314) 694-1000 Production site: Luling, LA 70070

Rhodia Inc., 259 Prospect Plains Rd., CN 7500, Cranbury, NJ 08512-7500, (609) 860-4000; Consumer Specialties Division, 2151 King St. Extension, Charleston, SC 29405-8339, (843)740-5200; Production site: Charleston, SC 29405-8339

Supresta US LLC, 420 Saw Mill River Rd., Ardsley Park, Ardsley, NY 10502, (914) 269-5900; Production site: Gallipolis Ferry, WV 25515-1721


Storage Conditions and Shipment:
Use sealed bubblers.

Packaging and Labeling:
T+ symbol
C symbol
R: 14-26/28-35-48/20
S: 1/2-7/8-26-36/37/39-45
UN Hazard Class: 6.1
UN Subsidiary Risks: 8
UN Packing Group: I


Pinacolone (75-97-8)

Also known as:
3,3-Dimethyl-2-butanone
Tert-Butyl methyl ketone
3,3-dimethylbutan-2-one
Pinacolin
T-Butyl methyl ketone

Molecular Formula: C6H12O

Description: Colorless to light yellow liquid, Peppermint or camphor-like odor


Chemical Vendors:
ABI Chemicals
AKos
Alfa Aesar
Alfa Chemistry
Angene
Anward
AOKBIO
AOKChem
Apollo Scientific Limited
Ark Pharm, Inc.
ASDI
BePharm
Bide Pharmatech
Chembo Pharma
ChemPacific
Conier Chem
eNovation Chemicals
Excel Asia
Fluorochem
Innocechem
Jalor-Chem
King Scientific
Labseeker
Letopharm
Merck Millipore
Molport
MP Biomedicals
Novochem
Oakwood
Otava Chemicals
OXchem
Paragos
Pharmlten
Ryan Scientific
Shanghai IS Chemical Technology
Sigma-Aldrich
SynQuest
Timtec
Tokyo Chemical Industry Ltd
Tractus Company Limited
Trylead Chemical
Vitas-M
Zerenex Molecular
Zylexa Pharma
AAA Chemistry
Ambinter
ChemFrog
Hangzhou Trylead Chemical Technology

Manufacturers: Bayer Corporation, 100 Bayer Road, Pittsburgh, PA 15205-9741, (412) 777-2000; Production site: Kansas City, MO

Bayer AG, Bayerwerk, Leverkusen, Nordrhein-Westfalen, Germany D-51368, +49 (214) 3 01; Production site: Leverkusen, Nordrhein-Westfalen
Pinacolyl alcohol (464-07-3)

Also known as: 3,3-dimethyl-2-butanol
Tert-Butyl methyl carbinol
3,3-Dimethylbutan-2-ol
2,2-Dimethyl-3-butanol
(S)-3,3-dimethyl-2-butanol

Molecular Formula: C₆H₁₄O

Description: Colorless liquid; mp = 5.6° C; Clear light yellow liquid;

Chemical Vendors: ABI Chemicals
Achemica
ACT Chemical
Alfa Chemistry
Angene
Anward
AOKChem
Apexmol
Ark Pharm, Inc.
Arking Pharma
BePharm
Capot Chemical
Chembo Pharma
Conier Chem
eNovation Chemicals
Finetech Industry
Fluorochem
GFS Chemicals
Jalor-Chem
King Scientific
Labseeker
Letopharm
Manchester Organics
Mizat Chemicals
Molport
Novochemistry
Otava Chemicals
OXchem
Pharmten  
Santa Cruz Biotechnology  
Sigma-Aldrich  
Thoreauchem  
Tokyo Chemical Industry Ltd  
Tractus Company Limited  
Trylead Chemical  
Zylexa Pharma  
AKos Consulting & Solutions  
Ambinter  
ChemFrog  
IS Chemical Technology  
MP Biomedicals  
TimTec

**Manufacturers:**  
Aldrich Chemical Co.  

### Potassium bifluoride (7789-29-9)

| Also known as:                  | Bifluorure de potassium [French]  
|                                | Hydrogen potassium fluoride  
|                                | Potassium hydrogen difluoride  
|                                | Potassium hydrogen fluoride  
|                                | Potassium monohydrogen difluoride  
|                                | Potassium acid fluoride  
|                                | Potassium fluoride  
|                                | Potassium hydrogen difluoride  
|                                | Potassium hydrogen difluoride, solid  
|                                | Potassium hydrogen difluoride, solution  

**Molecular Formula:** HF$_2$K  
**Description:** Colorless solid. White odorless crystalline powder ([http://hazmap.nlm.nih.gov](http://hazmap.nlm.nih.gov))  
**Chemical Vendor:** Alfa Aesar ([http://www.chemspider.com](http://www.chemspider.com))

### Potassium cyanide (151-50-8)

| Also known as:                  | Cyanide of potassium  
|                                | Potassium cyanide (K(CN))  
|                                | Kalium cyanid  
|                                | Caswell No. 688A  
|                                | Kalium cyanid [German]  
|                                | Potassium cyanide K(CN)  

**Molecular Formula:** CKN

Chemical Vendors: ABI Chem
AKos Consulting & Solutions
Angene Chemical
Angene International
Chembase.cn
ChemExper Chemical Directory
ChemFrog
Finetech Industry Limited
IS Chemical Technology
MolPort
MP Biomedicals
Sigma-Aldrich
TCI (Tokyo Chemical Industry)
Alfa Aesar
Chembo Pharma
Conier Chem
Tractus Company Limited

Manufacturers: Du Pont de Nemours & Co., Inc, Hq, 1007 Market St., Wilmington, DE 19898, (302) 774-1000

Chemicals and Pigments Department; Production site: Memphis, TN 38127

Eagle-Picher Industries, Inc., 250 East 5th St., Suite 500, Cincinnati, OH 45202, (513)721-7010; Production site: Lenexa, KS 66215


Packaging and Labeling: Note: A
T+ symbol
N symbol
R: 26/27/28-32-50/53
S: 1/2-7-28-29-45-60-61
UN Hazard Class: 6.1
UN Packing Group: I ([http://www.cdc.gov/niosh](http://www.cdc.gov/niosh))

**Potassium fluoride (7789-23-3)**

Also known as: Potassium fluoride (KF)
Potassium fluorurate
Fluorurate de potassium
Potassium fluorurate [French]
CCRIS 1568

Molecular Formula: FK
Description: White deliquescent crystals. White cubic crystals. Sharp saline taste.

Chemical Vendors: Abblis Chemicals
ABI Chemicals
Achemica
Alfa Aesar
Alfa Chemistry
Angene
Anward
AOKBIO
AOKChem
Apollo Scientific LimitedS
BePharm
BroadPharm
Chembo Pharma
Conier Chem
Fluorochem
J and K Scientific
King Scientific
Molport
Otava Chemicals
Pharmten
Shanghai IS Chemical Technology
Sigma-Aldrich
SynQuest
Tokyo Chemical Industry Ltd
Tractus Company Limited
Zylexa Pharma
AKos Consulting & Solutions
Amadis Chemical
Ambinter
Chembase.cn
ChemFrog
ChemMol
Finetech Industry Limited
MP Biomedicals

Manufacturers: Mallinckrodt Baker, Inc., 222 Red School Lane, Phillipsburg, NJ 08865, (908) 859-2151; Production site: Phillipsburg, NJ 08865
Solvay Fluorides, LLC, 3333 Richmond Avenue, Houston, TX 77098, (713)525-6500; Production site: Alorton, IL 62205

**Storage Conditions:** May be stored in aluminum containers (http://pubchem.ncbi.nlm.nih.gov)

### Sesquimustard: 1,2-Bis(2-chloroethylthio)ethane (3563-36-8)

<table>
<thead>
<tr>
<th>Also known as</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SM 1, Sesquimustard</td>
<td></td>
</tr>
<tr>
<td>Sesquisulfur Mustard</td>
<td></td>
</tr>
<tr>
<td>Sesquimustard Q</td>
<td></td>
</tr>
<tr>
<td>1,2-Bis(2-chloroethylthio)ethane</td>
<td></td>
</tr>
<tr>
<td>Agent Q</td>
<td></td>
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<tr>
<td>HSM 1</td>
<td></td>
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<tr>
<td>TL 86</td>
<td></td>
</tr>
<tr>
<td>Bis(2-chloroethylthio)ethane</td>
<td></td>
</tr>
</tbody>
</table>


### Sodium bifluoride (1333-83-1)

<table>
<thead>
<tr>
<th>Also known as</th>
<th>Sodium hydrogen difluoride</th>
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</thead>
<tbody>
<tr>
<td>Sodium acid fluoride</td>
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<tr>
<td>Sodium fluoride hydrofluoride</td>
<td></td>
</tr>
<tr>
<td>Caswell No. 747A</td>
<td></td>
</tr>
<tr>
<td>Sodium hydrogen fluoride</td>
<td></td>
</tr>
</tbody>
</table>

| Molecular Formula:                  | F2HNa                      |
| Chemical Vendors:                  | ABI Chem, AKos Consulting & Solutions, Angene Chemical, Chembase.cn, ChemFrog, ChemMol, IS Chemical Technology, Sigma-Aldrich |

Chemtech Indust Inc, 1655 Des Peres Rd, St Louis, MO 63131, (314) 966-9900

Essex Chem Corp, Essex Indust Chem Inc, 1401 Broad St, Clifton, NJ 07015, (201) 773-6306

Kali-Chemie AG, 41 W Putnam Ave, Greenwich, CT 06830, (203) 629-7900

American Fluoride Corp, 17 Huntington Pl, New Rochelle, NY 10801, (914) 235-6925

Philipp Brothers Chem Inc, 10 Columbus Circle, New York, NY 10019, (212) 586-6020

American Hoescht Corp, Specialty Products Group, Indust Chem, Route 202-206 North, Somerville, NJ 08876, (201) 231-2276


**Sodium cyanide (143-33-9)**

<table>
<thead>
<tr>
<th>Also known as</th>
<th>Cyanogran</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Cymag</td>
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<tr>
<td></td>
<td>Cyanide of sodium</td>
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<tr>
<td></td>
<td>Sodium cyanide (Na(CN))</td>
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<tr>
<td></td>
<td>Cyanide salts</td>
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<tr>
<td></td>
<td>NaCN</td>
</tr>
<tr>
<td></td>
<td>Hydrocyanic acid</td>
</tr>
<tr>
<td></td>
<td>Sodium salt</td>
</tr>
<tr>
<td></td>
<td>Sodium cyanide solution</td>
</tr>
</tbody>
</table>

**Molecular Formula:** CNNa

**Description:**
White, granular or crystalline solid with a faint, almond-like odor. White solid in form of granules, flakes or eggs, odorless when perfectly dry


**Chemical Vendors:**
ABIChem
AKos Consulting & Solutions
Angene Chemical
Angene International
Chembase.cn
ChemExper Chemical Directory
ChemFrog
ChemMol
Finetech Industry Limited
IS Chemical Technology
Sigma-Aldrich
Alfa Aesar
Conier Chem
Molport
Pharmten

Manufacturers: Cyanco Co., P.O. Box 1999, Winnemucca, NV 89446 (702)623-1214; Production site: Winnemucca, NV 89446

Degussa-Huls, Corp., 65 Challenger Rd., Ridgefield Park, NJ 07660, (201)641-6100; Production site: Theodore, AL 36590

DuPont, Hq, 1007 Market St., Wilmington, DE 19898, (302)774-1000; DuPont Specialty Chemicals, DuPont Performance, Specialty, and Fine Chemicals; Production site: Memphis, TN 38127

FMC Corp., 200 East Randolph Dr., Chicago, IL 60601, (312)861-6000; Chemical Products Group; Alkali Chemicals Division; Production site: Green River, WY

Sterling Chemicals, Inc., Hq, 1200 Smith St., Suite 1800, Houston, TX 77002, (713) 650-3700; Production site: Texas City, TX 77590

Shipping Name/Number DOT/UN/NA/IMO:
UN 3414; Sodium cyanide solution
UN 1689; Sodium cyanide, solid or solution
IMO 6.1; Sodium cyanide, solid; Sodium cyanide solution

Standard Transportation Number:
49 232 27; Sodium cyanide solution
49 232 28; Sodium cyanide, solid

Packaging and Labeling: Note: A
T+ symbol
N symbol
R: 26/27/28-32-50/53
S: 1/2-7-28-29-45-60-61
UN Hazard Class: 6.1
UN Packing Group: I

Sodium fluoride (7681-49-4)

Also known as: Fluoride
Sodium
Florocid
Pediaflor
Zymafluor
Ossin
Sodium fluoride (NaF)
Villiaumite
Antibulit

Molecular Formula: FNa
Description: Odorless, white powder or colorless crystals, cubic or tetragonal crystals

Chemical Vendors:
ABI Chem
Achemica
Amadis Chemical
Ambinter
Angene Chemical
Angene International
Chembase.cn
ChemFrog
ChemMol
Finetech Industry Limited
IS Chemical Technology
King Scientific
MolPort
MP Biomedicals
Sigma-Aldrich
Alfa Aesar
AOXChem
Apollo Scientific Limited
Chembo Pharma
Conier Chem
LGC Standards
Otava Chemicals
Pharmten
Ryan Scientific
Santa Cruz Biotechnology
SynQuest
Tractus Company Limited
Zylexa Pharma

Manufacturers:
KC Industries, 2420 Old Highway 60, Mulberry, FL 33860, (863) 425-1195;
Production site: Mulberry, FL 33860

Mallinckrodt Baker Inc., 222 Red School Lane, Phillipsburg, NJ 08865, (908) 859-2151; Phillipsburg, NJ 08865
Storage Conditions: Sodium fluoride solutions should be stored in tight, plastic containers.

Shipping Name/Number DOT/UN/NA/IMO:
- UN 1690; Sodium fluoride
- IMO 6.1; Sodium fluoride

Standard Transportation Number:
- 49 323 75; Sodium fluoride, solution
- 49 441 50; Sodium fluoride, solid

Packaging and Labeling: T symbol
- R: 25-32-36/38
- S: 1/2-22-36-45
- UN Hazard Class: 6.1
- UN Packing Group: III

Sodium sulphide (1313-82-2)

Also known as:
- Sodium sulfide (Na2S)
- Sodium monosulfide
- Disodium monosulfide
- Disodium sulphide
- Sodium sulfide hydrate
- Na2S, Sodium sulfide (VAN)

Molecular Formula: Na2S

Description:
White to yellow crystals; Light tan, yellow, or brick-red lumps or flakes; Deliquescent; Crystals with odor of rotten eggs; Extremely Hygroscopic

Chemical Vendors:
- ABBLIS Chemicals
- AKos Consulting & Solutions
- Chembase.cn
- Finetech Industry Limited
- IS Chemical Technology
- MolPort
- Sigma-Aldrich
- Alfa Aesar
- Angene

UN Sanctions on Iran and North Korea
Conier Chem
Cooper Chemicals
Pharmten
Tractus Company Limited

Manufacturers:
Chemical Products Corporation, Hq, P.O. Box 2470, Cartersville, GA 30120-1692, (770) 382-2144; Production site: Cartersville, GA 30120

Merichem Company, Hq, 4800 Texas Commerce Tower, Houston, TX 77002-3068, (713) 224-3030; Production site: 1914 Haden Road, Houston, TX 77015

PPG Industries, Inc, Hq, One PPG Place, 36 East, Pittsburgh, PA 15272, (412) 434-3131; Production site: P.O. Box 191, Natrium, WV 26155

Mobil Oil Corporation, Hq, 3225 Gallows Road, Fairfax, VA 22037-0001, (703) 846-3000; U.S. Marketing and Refining Division; Production sites: Beaumont, TX 77704, Joliet, IL 60434, Paulsboro, NJ 08066, Torrance, CA 90500

Shipping Name/Number DOT/UN/NA/IMO:
- UN 1385; Sodium sulfide, anhydrous or containing less than 30% water of crystallization
- UN 1849; Sodium sulfide, hydrated with not less than 30% water
- IMO 4.2; Sodium sulfide, anhydrous or Sodium sulfide with less than 30% water of crystallization
- IMO 8.0; Sodium sulfide, hydrated with not less than 30% water

Standard Transportation Number:
- 49 355 38; Sodium sulfide (corrosive liquid)
- 49 355 42; Sodium sulfide (corrosive liquid)
- 49 167 40; Sodium sulfide, anhydrous

Packaging and Labeling:
- C symbol
- N symbol
- R: 31-34-50
- S: 1/2-26-45-61
- UN Hazard Class: 4.2
- UN Packing Group: II

Sulphur dichloride (10545-99-0)

Also known as:
- Sulfur chloride (SCl2)
- 10545-99-0
- Dichlorosulfane
- Chlorine sulfide
Sulphur dichloride
Monosulfur dichloride

**Molecular Formula:** Cl₂S


**Manufacturers:**
- Nipa Laboratories Ltd., Nipa Industrial Estate, Llantwit Fardre, Pontypridd, Mid Glamorgan, Wales, United Kingdom CF38 2SN, +44 (1443) 20 53 11; Production site: Oswaldtwistle, Lancashire
- Tekchem, S.A. de C.V., Av. Jalisco No. 180, P. 5, Col. Tacubaya, Del. Miguel Hidalgo, Mexico, Distrito Federal, Mexico 11870, (5255) 5272-2221 / 2171; Production site: Salamanca, Guanajuato

**Chemical Vendors:** ABI Chem
- AKos Consulting & Solutions
- Angene Chemical
- Chembase.cn
- ChemMol
- IS Chemical Technology
- Conier Chem

**Storage Conditions:** Reacts violently with metals

**Shipping Name/Number DOT/UN/NA/IMO:**
- UN 1828; Sulfur chlorides
- IMO 8.0; Sulfur dichloride

**Standard Transportation Number:**
- 49 323 79; Sulfur dichloride (http://toxnet.nlm.nih.gov)

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**Sulphur monochloride (10025-67-9)**

**Also known as:**
- Disulfur dichloride
- Chlorosulfane
- Sulfur subchloride
- Disulphur dichloride
- Sulfur chloride (di)
- Thiosulfurous dichloride

**Molecular Formula:** Cl₂S₂

**Description:** Light-amber to yellow-red, oily liquid with a pungent, nauseating, irritating odor
UN Sanctions on Iran and North Korea

Chemical Vendors: ABI Chem
Ambinter
Chembase.cn
ChemFrog
Sigma-Aldrich
Alfa Chemistry
Merck Millipore
Molport
Ryan Scientific

Manufacturers: Occidental Chemical Corporation, Occidental Tower, 5005 LBJ Freeway, Dallas, TX 75244, (972) 404-3800

Chloro-Vinyls Group; Production sites: Convent, LA 70723; Hahnville, LA 70057

Performance Products Group; Production site: Niagara Falls, NY 14303

Shipping Name/Number DOT/UN/NA/IMO:
UN 1828; Sulfur chlorides
IMO 8.0; Sulfur monochloride

Standard Transportation Number:
49 323 80; Sulfur chloride (mono); chloride of sulfur

Packaging and Labeling: T symbol
C symbol
N symbol
R: 14-20-25-29-35-50
S: 1/2-26-36/37/39-45-61
UN Hazard Class: 8
UN Packing Group: I

Tabun (GA): O-Ethyl N,N-dimethyl phosphoramidocyanide (77-81-6)

Also known as: Ethyl dimethylphosphoramidocyanide
Taboon A
Gelan I
Trilon 83
Dimethylamidoethoxyphosphoryl cyanide

Molecular Formula: C5H11N2O2P

Description: Colorless to brown liquid with a mild fruity odor; Odorless when pure

Chemical Vendors: ABI Chem
Shipping Name/Number DOT/UN/NA/IMO:
UN 2810; Tabun


Thiodiglycol (111-48-8)

Also known as:
- Thiodiglycol
- Thiodiethylene glycol
- Thiodiethanol
- Tedegyl
- 2,2’thiodiethanol
- Bis(2-hydroxyethyl) sulfide
- Bis(2-hydroxyethyl)sulfide

Molecular Formula: C4H10O2S

Description:

Chemical Vendors:
- ABI Chem
- AKos Consulting & Solutions
- Amadis Chemical
- Ambinter
- Angene Chemical
- Angene International
- Chembase.cn
- ChemExper Chemical Directory
- ChemFrog
- Chemical Synthesis Database
- ChemMol
- Enamine
- IS Chemical Technology
- Jamson Pharmachem Technology
- Mcule
- MP Biomedicals
- Sigma-Aldrich
- TCI (Tokyo Chemical Industry)
- TimTec
Thionyl chloride (7719-09-7)

Also known as: Sulfinyl chloride
Thionyl dichloride
Sulfurous oxychloride
Sulfur oxychloride
Sulfurous dichloride
7719-09-7
Sulfinyl dichloride

Molecular Formula: Cl2OS

Description: Colorless to yellow to reddish liquid with a pungent odor like sulfur dioxide, fumes form when exposed to moist air (http://pubchem.ncbi.nlm.nih.gov and http://hazmap.nlm.nih.gov)

Chemical Vendors: ABI Chem
Achemica
Manufacturers:

- AKos Consulting & Solutions
- Angene Chemical
- Angene International
- Chembase.cn
- ChemFrog
- ChemMol
- Finetech Industry Limited
- Hangzhou Trylead Chemical Technology
- IS Chemical Technology
- King Scientific
- Sigma-Aldrich
- TCI (Tokyo Chemical Industry)

Bayer Corporation (formerly known as Miles Inc), One Mellon Center, 500 Grant Street, Pittsburgh, PA 15219, (412) 394-5500

Industrial Chemicals Division Inorganic Chemicals Division, Inorganic Chemicals, 100 Bayer Rd, Pittsburgh, PA 15205, (412) 777-2000; Production site: Baytown, TX 77521

Occidental Petroleum Corporation, Hq, 10889 Wilshire Boulevard, Suite 1500, Los Angeles, CA 90024, (213) 879-1700; Subsidiary: Occidental Chemical Corporation, 5005 LBJ Freeway, Dallas, TX 75244, (214) 404-3800

Electrochemicals & Proprietary Products Div; Proprietary Products; Production site: Niagara Falls, NY 14303

Storage Conditions:

Thionyl chloride is classified as a corrosive material; it is shipped and stored in glass-lined steel tanks, zinc-coated (galvanized) steel drums, or special plastic drums having a DOT permit. Stainless steel (304L or 316L) may be used if all traces of moisture are excluded. Thionyl chloride stored in tanks or drums should be kept cool and away from direct sunlight and water.

Shipping Name/Number DOT/UN/NA/IMO:

- UN 1836; Thionyl chloride
- IMO 8.0; Thionyl chloride

Standard Transportation Number:

- 49 300 60; Thionyl chloride

Packaging and Labeling:

- C symbol
- R: 14-20/22-29-35
- S: 1/2-26-36/37/39-45
- UN Hazard Class: 8
- UN Packing Group: I

Triethanolamine (102-71-6)

Also known as: Trolamine
2,2',2''-Nitrilotriethanol
Daltogen
Sterolamide
Tris(2-hydroxyethyl)amine
Triethylolamine
Trihydroxytriethylamine

Molecular Formula: C₆H₁₅NO₃


Chemical Vendors: AAA Chemistry
ABI Chem
Achemica
AKos Consulting & Solutions
Ambinter
Angene Chemical
Ark Pharm, Inc.
Chembase.cn
ChemExper Chemical Directory
ChemFrog
Enamine
IS Chemical Technology
King Scientific
MP Biomedicals
Sigma-Aldrich
TCI (Tokyo Chemical Industry)
TimTec
Vitas-M Laboratory

Manufacturers: Dow Chemical USA, 2030 Dow Center, Midland, MI 48642, (989) 636-1000; Production sites: Seadrift, TX 77983; Taft, La 70057

Equistar Chemicals LP, One Houston Center, 1221 McKinney St, Suite 700, Houston, TX 77010, (713) 652-7200; Production site: Bayport, TX 77507

Huntsman LLC, 3040 Post Oak Blvd, Houston, TX 77056, (713) 235-6000; Production site: Port Neches, TX 77651

**Triethanolamine hydrochloride (637-39-8)**

Also known as:  
- Triethanolamine hydrochloride  
- TEA-Hydrochloride  
- 2,2',2''-Nitrilotriethanol Hydrochloride  
- Triethanolammonium chloride  

Molecular Formula:  
C6H16ClNO3  

Chemical Vendors:  
- AAA Chemistry  
- ABI Chem  
- Achemica  
- AKos Consulting & Solutions  
- Angene Chemical  
- Angene International  
- Chembase.cn  
- ChemExper Chemical Directory  
- ChemFrog  
- ChemMol  
- Hangzhou Trylead Chemical Technology  
- IS Chemical Technology  
- MP Biomedicals  
- Sigma-Aldrich  
- TCI (Tokyo Chemical Industry)  

**Triethyl phosphite (122-52-1)**

Also known as:  
- Phosphorous acid  
- Triethyl ester  
- Triethoxyphosphine  
- Ethyl phosphite  
- (EtO)3P  
- Phosphorous Acid Triethyl Ester  

Molecular Formula:  
C6H15O3P

Description:  
Colorless liquid; Characteristic, obnoxious phosphite odor  

Chemical Vendors:  
- ABI Chem  
- AKos Consulting & Solutions  
- Amadis Chemical  
- Ambinter  
- Angene International  
- Anward
UN Sanctions on Iran and North Korea

Ark Pharm, Inc.
Chembase.cn
ChemExper Chemical Directory
ChemFrog
Chemical Synthesis Database
ChemMol
Finetech Industry Limited
IS Chemical Technology
Jamson Pharmachem Technology
King Scientific
MP Biomedicals
Sigma-Aldrich
TCI (Tokyo Chemical Industry)
ZINC

Manufacturers: Rhodia Inc., 259 Prospect Plains Road, CN 7500, Cranbury, NJ 08512-7500, (609) 860-4000, Consumer Specialties Division; Production site: Charleston, SC 29405-8339

Shipping Name/Number DOT/UN/NA/IMO:
- UN 2323; Triethyl Phosphite
- IMO 3.3; Triethyl Phosphite

Packaging and Labeling:
- UN Hazard Class: 3
- UN Packing Group: III

Trimethyl phosphite (TMP) (121-45-9)

Also known as:
- Phosphorous acid
- Trimethyl ester
- Trimethoxyphosphine
- Methyl phosphite
- 121-45-9
- Trimethylphosphite
- Trimethylfosfit [Czech]

Molecular Formula: C₃H₉O₃P

Description: Colorless liquid with a distinctive, pungent odor; odor characteristics are described as irritating, pungent, oily and at higher concentrations, pyridine-like.

Chemical Vendors:
- ABI Chem
- AKos Consulting & Solutions
- Angene Chemical
- Angene International
Anward
Chembase.cn
ChemExper Chemical Directory
ChemFrog
ChemMol
Finetech Industry Limited
IS Chemical Technology
King Scientific
MP Biomedicals
Sigma-Aldrich
TCI (Tokyo Chemical Industry)
ZINC
Alfa Aesar
BroadPharm
Chembo Pharma
Conier Chem
Fluorochem
Jalor-Chem
Letopharm
Merck Millipore
Molport
Pharmenten Tractus Company Limited

Manufacturers: Rhodia Inc., 8 Cedar Brook Drive, Cranbury, NJ 08512, (609) 860-4000;
Consumer Specialties Division, 3440 Fairfield Rd, Baltimore, MD 21226, (410) 355-2600; Production site: Charleston, SC 29405

Schumacher, 1969 Palomar Oaks Way, Carlsbad, CA 92009, (800) 545-9242;
Production site: Carlsbad, CA 92009

Storage Conditions: Store and handle under a nitrogen blanket.
Shipping Name/Number DOT/UN/NA/IMO:
UN 2329; Trimethyl phosphite
IMO 3.0; Trimethyl phosphite

Packaging and Labeling:
UN Hazard Class: 3
UN Packing Group: III

VX: O-Ethyl S-2-diisopropylaminoethyl methyl phosphonothiolate (50782-69-9)

Also known as: VX (van)
Tx 60
O-Ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate

Molecular Formula: C₁₁H₂₆NO₂PS
Description: VX is a clear, amber-colored, odorless, oily liquid. It is miscible with water and soluble in all solvents. It is the least volatile nerve agent; VX is an odorless, colorless to straw-colored liquid (http://pubchem.ncbi.nlm.nih.gov and http://hazmap.nlm.nih.gov)

Chemical Vendors: ABI Chem
Angene Chemical
Angene International
Chembase.cn

Shipping Name/Number DOT/UN/NA/IMO:
UN 2810; VX (http://toxnet.nlm.nih.gov)

DUAL-USE CHEMICAL MANUFACTURING FACILITIES AND EQUIPMENT AND RELATED TECHNOLOGY
I. MANUFACTURING FACILITIES AND EQUIPMENT S/2006/853 ANNEX

1. Reaction Vessels, Reactors or Agitators

Reaction vessels or reactors, with or without agitators: Reaction vessels or reactors, with or without agitators, with total internal (geometric) volume greater than 0.1 m³ (100 L) and less than 20 m³ (20,000 L), where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from the following materials:

   (a) nickel or alloys with more than 40% nickel by weight;
   (b) alloys with more than 25% nickel and 20% chromium by weight;
   (c) fluoropolymers;
   (d) glass or glass-lined (including vitrified or enameled coating);
   (e) or tantalum alloys;
   (f) titanium or titanium alloys; or
   (g) zirconium or zirconium alloys

Dual-Use items readily available for civilian or military use.
Agitators: Agitators for use in the above-mentioned reaction vessels or reactors, where all surfaces of the agitator or component that come in direct contact with the chemical(s) being processed or contained are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight;
(b) alloys with more than 25% nickel and 20% chromium by weight;
(c) fluoropolymers;
(d) glass or glass-lined (including vitrified or enameled coating);
(e) tantalum or tantalum alloys;
(f) titanium or titanium alloys; or
(g) zirconium or zirconium alloys

2. Storage Tanks, Containers or Receivers

Storage tanks, containers or receivers with a total internal (geometric) volume greater than 0.1 m³ (100 L) where all surfaces that come in direct contact with the chemical(s) being processed or contained are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight;
(b) alloys with more than 25% nickel and 20% chromium by weight;
(c) fluoropolymers;
(d) glass or glass-lined (including vitrified or enameled coating);
(e) tantalum or tantalum alloys;
(f) titanium or titanium alloys; or
(g) zirconium or zirconium alloys

3. Heat Exchangers or Condensers

Heat exchangers or condensers with a heat transfer surface area less than 20 m², where all surfaces that come in direct contact with the chemical(s) being processed are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight;
(b) alloys with more than 25% nickel and 20% chromium by weight;
(c) fluoropolymers;
(d) glass or glass-lined (including vitrified or enameled coating);
(e) graphite;
(f) tantalum or tantalum alloys;
(g) titanium or titanium alloys;
(h) zirconium or zirconium alloys

4. Distillation or Absorption Columns
Distillation or absorption columns of internal diameter greater than 0.1 m, where all surfaces that come in direct contact with the chemical(s) being processed are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight;  
(b) alloys with more than 25% nickel and 20% chromium by weight;  
(c) fluoropolymers;  
(d) glass or glass-lined (including vitrified or enameled coating);  
(e) graphite;  
(f) tantalum or tantalum alloys;  
(g) titanium or titanium alloys; or  
(h) zirconium or zirconium alloys

5. Filling Equipment

Remotely operated filling equipment in which all surfaces that come in direct contact with the chemical(s) being processed are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight; or  
(b) alloys with more than 25% nickel and 20% chromium by weight

6. Valves

Valves, in which all surfaces that come in direct contact with the chemical(s) being produced, processed, or contained are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight;  
(b) alloys with more than 25% nickel and 20% chromium by weight;  
(c) fluoropolymers;  
(d) glass or glass-lined (including vitrified or enameled coating);  
(e) tantalum or tantalum alloys;  
(f) titanium or titanium alloys; or  
(g) zirconium or zirconium alloys

7. Multi-Walled Piping

Multi-walled piping incorporating a leak detection port, in which all surfaces that come in direct contact with the chemical(s) being processed or contained are made from the following materials:

(a) nickel or alloys with more than 40% nickel by weight;  
(b) alloys with more than 25% nickel and 20% chromium by weight;  
(c) fluoropolymers;  
(d) glass or glass-lined (including vitrified or enameled coating);  
(e) graphite;
(f) tantalum or tantalum alloys;
(g) titanium or titanium alloys; or
(h) zirconium or zirconium alloys

8. Pumps

Pumps with manufacturer’s specified maximum flow-rate greater than 0.6 m³/h, or vacuum pumps with manufacturer’s specified maximum flow-rate greater than 5 m³/h (under standard temperature (273 K [0°C]) and pressure (101.3 kPa) conditions), in which all surfaces that come into direct contact with the chemical(s) being processed are made from any of the following materials:

(a) nickel or alloys with more than 40% nickel by weight;
(b) alloys with more than 25% nickel and 20% chromium by weight;
(c) fluoropolymers;
(d) glass or glass-lined (including vitrified or enameled coating);
(e) graphite;
(f) tantalum or tantalum alloys;
(g) titanium or titanium alloys;
(h) zirconium or zirconium alloys;
(i) ceramics; or
(j) ferrosilicon

9. Incinerators

Incinerators designed to destroy CW agents, controlled precursors or chemical munitions, having specially designed waste supply systems, special handling facilities, and an average combustion chamber temperature greater than 1000°C, in which all surfaces in the waste supply system that come into direct contact with the waste products are made from or lined with the following materials:

(a) nickel or alloys with more than 40% nickel by weight;
(b) alloys with more than 25% nickel and 20% chromium by weight; or
(c) ceramics
(a) designed for continuous operation and usable for the detection of chemical warfare agents or controlled precursors at concentrations of less than 0.3 mg/m³; or
(b) designed for the detection of cholinesterase-inhibiting activity

### BIOLOGICAL AGENTS

**S/2006/853 ANNEX**

**Viruses**

- Chikungunya Virus
- Congo-Crimean haemorrhagic fever virus
- Dengue fever virus
- Eastern equine encephalitis virus
- Ebola virus
- Hantaan virus
- Junin virus
- Lassa fever virus
- Lymphocytic choriomeningitis virus
- Machupo virus
- Marburg virus
- Monkey pox virus
- Rift Valley fever virus
- Tick-borne encephalitis virus (Russian Spring-Summer encephalitis virus)
- Variola virus
- Venezuelan equine encephalitis virus
- Western equine encephalitis virus
- White pox
- Yellow fever virus
- Japanese encephalitis virus
- Kyasanur Forest virus
- Louping ill virus
- Murray Valley encephalitis virus
- Omsk haemorrhagic fever virus
- Oropouche virus
- Powassan virus
- Rocio virus
- St Louis encephalitis virus

**Rickettsiae**

- Coxiella burnetii
Bartonella quintana (Rochalimea quintana, Rickettsia quintana)
Rickettsia prowazeki
Rickettsia rickettsii

Bacteria

Bacillus anthracis
Brucella abortus
Brucella melitensis
Brucella suis
Chlamydia psittaci
Clostridium botulinum
Francisella tularensis
Burkholderia mallei (Pseudomonas mallei)
Burkholderia pseudomallei (Pseudomonas pseudomallei)
Salmonella typhi
Shigella dysenteriae
Vibrio cholera
Yersinia pestis
Clostridium perfringens, epsilon toxin producing types
Enterohaemorrhagic Escherichia coli, serotype O157 and other verotoxin producing serotypes

Toxins

Botulinum toxins
Clostridium perfringens toxins
Conotoxin
Ricin
Saxitoxin
Shiga toxin
Staphylococcus aureus toxins
Tetrodotoxin
Verotoxin
Microcystin (Cyanginosin)
Abrin
Cholera toxin
T-2 toxin
HT-2 toxin

Genetically-Modified Organisms

1. Genetically modified organisms or genetic elements from microorganisms in the list that contain nucleic acid sequences associated with pathogenicity.
2. Genetically modified organisms or genetic elements that contain nucleic acid sequences coding for any of the toxins on the list.

**PLANT PATHOGENS**
S/2006/853 ANNEX

**Bacteria**

Xanthomonas albilineans  
Xanthomonas campestris pv. Citri  
Xanthomonas oryzae pv. oryzae (Pseudomonas campestris pv. oryzae)

**Fungi**

Colletotrichum coffeanum var. virulans (Colletotrichum kahawae)  
Cochliobolus miyabeanus (Helminthosporium oryzae)  
Microcyclus ulei (syn. Dothidella ulei)  
Puccinia graminis (syn. Puccinia graminis f. sp. tritici)  
Puccinia striiformis (syn. Puccinia glumarum)  
Pyricularia grisea/Pyricularia oryzae

**Genetically-modified Organisms**

Genetically modified organisms or genetic elements from microorganisms in the list that contain nucleic acid sequences associated with pathogenicity.

**ANIMAL PATHOGENS**
S/2006/853 ANNEX

**Viruses**

African swine fever virus  
Avian influenza virus 2  
Bluetongue virus  
Foot and mouth disease virus  
Goat pox virus  
Herpes virus (Aujeszky’s disease)  
Hog cholera virus (synonym: swine fever virus)  
Lyssa virus  
Newcastle disease virus  
Peste des petits ruminants virus  
Porcine enterovirus type 9 (synonym: swine vesicular disease virus)
Rinderpest virus
Sheep pox virus
Teschen disease virus
Vesicular stomatitis virus

Bacteria

Mycoplasma Mycoides

Genetically-modified Organisms

Genetically modified organisms or genetic elements from microorganisms in the list that contain nucleic acid sequences associated with pathogenicity.

DUAL-USE BIOLOGICAL EQUIPMENT AND RELATED TECHNOLOGY

I. EQUIPMENT

1. Complete containment facilities at P3 or P4 containment level:

Complete containment facilities that meet the criteria for P3 or P4 (BL3, BL4, L3, L4) containment as specified in the WHO Laboratory Biosafety manual (2nd edition, Geneva, 1993) should be subject to export control.

2. Fermenters:

Fermenters capable of cultivation of pathogenic micro-organisms, viruses or for toxin production, without the propagation of aerosols, having a capacity of 100 litres or greater. Fermenters include bioreactors, chemostats, and continuous-flow systems.

3. Centrifugal Separators:

Centrifugal separators capable of the continuous separation of pathogenic micro-organisms, without the propagation of aerosols, and having all the following characteristics:

- one or more sealing joints within the steam containment area;
- a flow rate greater than 100 litres per hour;
- components of polished stainless steel or titanium;
- capable of in-situ steam sterilisation in a closed state.

4. Cross (tangential) Flow Filtration Equipment:
Cross (tangential) flow filtration equipment capable of continuous separation of pathogenic micro-organisms, viruses, toxins, or cell cultures, without the propagation of aerosols, having all the following characteristics:

- a total filtration area equal to or greater than 5 square metres;
- capable of being steam-sterilized without preliminary dismantling.

5. Freeze-drying Equipment:

Steam sterilisable freeze-drying equipment with a condenser capacity of 50 kgs of ice or greater in 24 hours and less than 1000 kgs of ice in 24 hours.

6. As follows:

(a) Protective suits with full or partial ventilation.
(b) Class III biological safety cabinets or isolators with similar performance standards (e.g., flexible isolators, dry boxes, anaerobic chambers, glove boxes, or laminar flow hoods (closed with vertical flow).

7. Aerosol inhalation chambers:

Chambers designed for aerosol challenge testing with micro-organisms, viruses, or toxins and having a capacity of 1 cubic meter or greater.

8. Complete spraying systems specially designed or modified for dissemination of biological agents.

No further information.

9. Equipment for the micro-encapsulation of live micro-organisms and toxins in the range of 1–10 um particle size

Equipment for the micro-encapsulation of live micro-organisms and toxins in the range of 1–10 um particle size, specifically:

(a) interfacial polycondensors;
(b) phase separators.

10. Fermenters of less than 20 litre capacity with special emphasis on aggregate orders or designs for use in combined systems.

No further information.
11. Conventional or turbulent air-flow clean-air rooms and self-contained fan-HEPA filter units that may be used for P3 or P4 (BL3, BL4, L3, L4) containment facilities.

No further information.