5. SEGURETAT I HIGIENE

TAGO CHEMICALS S.A.
Engineering Solutions

"El azar no existe, Dios no juega a los dados con el universo"

5- SEGURETAT I HIGIENE

5.1 INTRODUCCIÓ

La part de Seguretat i higiene és un dels punts importants de la planta, ja que en aquesta part es detallen i s'analitzen les possible situacions de risc que es poden donar en aquesta, a fi de prevenir-les o minimitzar-les, en cas de no poder evitar-les.

Amb aquest anàlisi es vol minimitzar el impacte d'un possible accident. Per tal de realitzar l'estudi seran necessàries moltes dades, tals com climatologia de la zona, sismologia, propietats de les substàncies a tractar, etc.

5.2 LEGISLACIÓ REFERENT A SEGURETAT I SALUT

5.2.1 LEGISLACIÓ GENERAL

- *Ley 31/01/1995 de 8 de noviembre, Ley de Prevención de Riesgos Laborales*
- *R.D. 1627/1997 de 24 de octubre sobre Seguridad, Salud y Medicina en el Trabajo.*
- *Ordenanza General de Seguridad e Higiene en el Trabajo de 9 de marzo de 1971.*
- *R.D. 485/1997 de 14 de abril sobre Disposiciones Mínimas de Seguridad y Salud en los lugares de Trabajo.*
- *R.D. 1.316/1989, de 27 d'octubre, sobre protecció dels treballadors enfront els riscos derivats de l'exposició al soroll durant el treball. BOE núm. 263, de 2 de novembre de 1989.*
- *R.D. 486/1997 de 14 de abril sobre Disposiciones Mínimas en Materia de Señalización, Seguridad y Salud en el Trabajo.*
- *R.D. 39/1997 de 17 de enero, Reglamento de los Servicios de Prevención (B.O.E. de 31 de enero de 1997).*
- Reglamento (CE) Nº 1272/2008 sobre clasificación, etiquetado y sobre clasificación, etiquetado y envasado de sustancias y mezclas.
- *R.D. 2200/1995 Reglamento de la infraestructura para la calidad y la seguridad industrial.*
- *R.D. 379/2001, << ITC MIE-APQ1>>, <<ITC MIE-APQ6>>, <<ITC MIE-APQ7>> B.O.E núm. 112 del 10 de mayo de 2001.*
- *R. D. 997/2002, de 27 de septiembre, por el que se aprueba la norma de construcción sismo resistente: parte general y edificación (NCSR-02).*
- *Orden de 17 de mayo de 1974 sobre Normas Técnicas Reglamentarias sobre homologación de Medios de Protección Personal (B.O.E. nº 128 29/05/1974).*

5.2.2 LEGISLACIÓ PER PREVENCIÓ D'INCENDIS

- *R.D. 1942/1993, de 5 de diciembre, por el que se aprueba el Reglamento de instalaciones de protección contra incendios.*
- *Norma básica de la Edificación "NBE-CPI/96: Condiciones de Protección contra incendios en los Edificios", aprobada por R.D. 2177/1996, de 4 de octubre.*
- *R.D. 2267/2004, de 3 de diciembre por el que se aprueba el Reglamento de seguridad contra incendios en establecimientos industriales.*

5.2.3 LEGISLACIÓ D'INSTAL·LACIONS ELÈCTRIQUES

- *R.D. 2413/1973 de 20 de septiembre, Reglamento Electrotécnico de Baja Tensión e Instrucciones Complementarias (REBT) (B.O.E. de 9 de octubre de 1973), modificado por el R.D. de 9 de octubre de 1985.*
- *R.D. del 9 de octubre de 1985, según el cual se modifica el anterior Reglamento Electrotécnico de Baja Tensión (REBT).*
- *R.D: 3151/1986, de 28 de noviembre, por el que se aprueba el Reglamento de Líneas Aéreas de Alta Tensión. Modificado en BOE nº224 08/03/1963.*
- *R.D. 842/2002, de 2 de agosto, por el que se aprueba el Reglamento Electrotécnico para Baja*

5.2.4 LESGILACIÓ SOBRE MAQUINÀRIA

- *R.D. 2060/2008, Reglamento de 12 de diciembre, por el que se aprueba el Reglamento de equipos a presión y sus instrucciones técnicas complementarias*
- *R.D. 2291/1985 de 8 de noviembre, Reglamento de Aparatos de Elevación Mantenimiento de los mismo (B.O.E. de 11 de diciembre de 1985).*
- *R.D. 1495/1986 de 26 de mayo, Reglamento de Seguridad en las Máquinas (B.O.E. de 21 de julio de 1986). Modificado en el B.O.E. de 4 de octubre de 1986.*

- *Directiva Comunitaria 89/392/CE, relativa a la aproximación de las legislaciones de los Estados Miembros sobre máquinas. Transpuesta en el R.D. 1435/1992 de 20 de enero (B.O.E. de 8 de febrero de 1995).*

- *Orden de 8 de abril de 1991. ITC-MIE-MSG1: Máquinas, Elementos de Máquinas Sistemas de Protección Utilizados (B.O.E. de 11 de abril de 1991).*

5.2.5 LEGISLACIÓ SOBRE QUIPS DE PROTECCIÓ (EPI)

- *R.D. 1407/1992, de 20 de noviembre, sobre Comercialización y Libre Circulación Intracomunitaria de los Equipos de Protección Individual (BOE de 28 de diciembre de 1992), modificado por la O.M. de 16 de mayo de 1994 y por el R.D. 159/1995, de 3 de febrero (BOE de 8 de marzo de 1995).*

- *R.D. 773/1997, de 30 de mayo, sobre Disposiciones Mínimas de Seguridad y Salud relativas a la Utilización por los Trabajadores de Equipos de Protección Individual (BOE nº140 12/06/1997).*

- *R.D. 1215/1997, de 18 de julio, por el que se establecen las disposiciones mínimas de seguridad y salud para la utilización por los trabajadores de los equipos de trabajo.*

5.2.6 NORMES

- *C.T.E.: Código Técnico de Edificación.*
- *N.B.E.: Normas Básicas de Edificación*
- *N.T.E.: Norma Tecnológica de Edificación*
- *E.B.S.: Estudio de Seguridad y Salud.*
- *R.A.P.: Reglamento de Aparatos a Presión.*
- *R.E.B.T.: Reglamento Electrotécnico de Baja Tensión.*
- *R.E.A.T.: Reglamento Electrotécnico de Alta Tensión.*
- *R.A.M.I.N.P.: Reglamento de Actividades Molestas, Insalubres, Nocivas y Peligrosas*

5.3 RISCS DE LA INDÚSTRIA

En la industria química se solen agrupar els riscos en tres grans grups, els quals poden ser molt perjudicials per la població, ja sigui pels treballadors, o per les zones urbanes prop de la industria, per tant el que s'ha de intentar és reduir al màxim aquests riscos i minimitzar els efectes que puguin causar.

Els riscos principals que es volen minimitzar són els produïts per explosió, per fuga o per incendi. Per tal de reduir-los cal tenir especial atenció a l'hora de la manipulació, pels efectes que poden tenir sobre la salut dels operaris, com per exemple els efectes corrosius del HF. Per minimitzar riscos cal conèixer quins son els compostos químics que hi ha a la planta(zona).

Per decidir quins són els elements de seguretat que cal tenir disponibles en qualsevol zona de treball se segueix el Reial Decret 486/1997 del 14 d'abril, el qual determina les disposicions "mínimes de seguretat i salut en els llocs de treball", així com la llei 31/1995 del 8 de novembre

5.3.1 MESURES DE SEGURETAT I PREVENCIÓ GENERAL

En aquest punt es volen donar una sèrie de recomanacions per tal de reduir i prevenir cada una de les possibles situacions de risc que es puguin donar en la operació de la planta. Per començar es tractaran els riscos principals (fuga, explosió i incendi), i altres com el risc elèctric

5.3.1.1 En cas de fuga

Es diu que una fuga és qualsevol escapament d'un fluid per una esquerda o forat; això comporta un risc degut a la possibilitat que esdevingui un incendi, o riscos per a la seguretat de les persones si els productes vesats són tòxics. Per això cal confinar aquests vessaments, de manera que l'efecte d'aquests sigui el mínim i no afecti ni a persones ni al medi ambient.

Hi ha tres tipus de mesures protectores que poden ser aplicades:

- Mesures protectores per tal de reduir la freqüència o probabilitat que succeeixi aquest tipus d'accident.

- Mesures protectores per tal de minimitzar l'expansió i abast del núvol o vessaments un cop produïda la fuita.

- Mesures protectores usades per disminuir els efectes i les conseqüències dels núvols i vessaments mitjançant la protecció activa i passiva dels subjectes que poden quedar fora de l'abast del vessament.

A més a més cal instal·lar sensors per a la detecció de gasos i els venteigs conduir-los a la unitat de tractat corresponent, també s'instal·laran cortines d'aigua per tal de reduir la temperatura del tanc per evitar un calentament excessiu i que els productes vaporitzessin.

5.3.1.2 En cas d'explosió

En química una explosió es defineix com Reacció química molt ràpida acompanyada de l'alliberament d'una gran quantitat d'energia, producció de gasos i un soroll intens, això genera ones expansives al seu voltant, segons com siguin aquestes ones es pot dir si la explosió es una deflagració, ona subsònica, o detonació si es produeixen ones de xoc(supersòniques).

També es poden classificar segons on han ocorregut aquestes explosions:

- Confinades: si la fuita s'ha produït en un recipient, és a dir, el fluid està confinat. Si el gas es troba dins dels límits d'inflamabilitat i existeix una font d'ignició, això provoca l'explosió del fluid, amb la consegüent ruptura del recipient contenidor, creant una ona de pressió que accelera i expulsa els fragments del recipient creant perillosos projectils, que poden crear efectes en cadena causant accidents de major magnitud.

- No confinades: quan els vapors d'un gas generats a partir d'una fuga, o el vessament de líquid que a partir del qual es forma el núvol genera alguna situació de risc, dispersant-se la mateixa fins un punt d'ignició,; que el núvol immediatament després de la seva formació s'inflami i també provoqui un incendi al líquid.

- BLEVES: són explosions que es produeixen per la descompressió sobtada d'un líquid, de manera que passant d'un estat estable a un estat d'ebullició, de manera que es pot generar una bola de foc si el líquid es inflamable. Aquest tipus d'explosions són comuns quan es produeix un incendi que rodeja externament un tanc pressuritzat i es produeix una fissura o ruptura.

5.3.1.3 En cas d'incendi

Per definició un incendi és un foc de grans dimensions capaç de cremar grans superfícies i edificis, que es propaga, no està controlat, i fa grans estralls.

La principal diferencia entre un incendi i una explosió és la velocitat a la que l'energia es alliberada, mentre en els incendis l'energia s'allibera lentament, en una explosió l'energia és alliberada en l'ordre dels microsegons.

Un incendi es produeix quan hi ha una reacció química entre les substancies que formen el conegut com tetraedre de foc, el qual serà explicat més endavant.

Com a conseqüència de l'incendi es desprenen grans quantitats de calor en forma de radiació, també es generen fums i gasos deguts a la combustió.

5.3.1.4 Risc d'exposició a productes químics

Una exposició continua o de llarga durada, per inhalació, radiació, ingestió, absorció cutània, de manera no controlada pot desencadenar en malalties cròniques o la mort. Una exposició curta a certs productes pot tenir conseqüències lleus o severes depenent de la toxicitat de la substància. Per evitar aquesta exposició s'ha de fer una anàlisi de les substàncies amb les que es treballa a la planta i segons la zona.

5.3.1.5 Risc elèctric

El risc elèctric es un dels que es presenta més freqüentment a la indústria, i sol comportar els accidents més greus.

Els principals riscos que presenta l'electricitat són els derivats de possibles contactes, entre equips(directa) o de manera indirecta. Els accidents que causen

aquests contactes van des de cremades lleus a la pell si no és un contacte directe i gaire prolongat, fins a la mort de la persona si el contacte és directe. A part, també poden provocar pars cardíacs, asfixia, paràlisi contractures permanents...

Per disminuir el risc elèctric són necessàries unes mesures de prevenció i protecció, tals com mitjans de protecció individuals, medis informatius(senyalització, senyals de prohibició) i que es controlin i revisin constantment les instal·lacions.

5.4 CLASSIFICACIÓ DE LES ÀREES DE LA PLANTA

Per conèixer els riscos específics de cada planta, cal determinar quins perills presenten i en quina proporció, ja que no totes les indústries presenten els mateixos perills. Al 1961 es va redactar el Reial Decret 2414/1961, *"Reglamento de actividades molestas, insalubres, nocivas y peligrosas",* el qual classificava cada planta segons una nomenclatura específica la qual relacionava l'activitat amb els perills associats a l'activitat, d'aquesta manera s'aconseguia identificar els perills per tal de planificar adequadament els plans d'actuació davant d'accidents i emergències sorgides, així com la prevenció dels mateixos.

Taula 5.1 Identificació i classificació dels riscos de la planta segons el Reial Decret 2414/1961

RISCOS DE LA PLANTA		
Codi R.D.	Activitat	Efectes
311 11	Fabricació d'àcids minerals	Alliberament de gasos nocius
311 449	Obtenció de tetraclorur de carboni	Alliberament de gasos inflamables i obtenció de productes combustibles
Sense classificació decimal	Activitats relacionades amb la producció, envàs, emmagatzemament, transport y/o distribució de combustibles gasosos de base hidrocarburada com el propà, butà i els seus isòmers	Productes inflamables

Al 2001 aquest decret va ser derogat i substituït per un nou decret, el Reial Decret 374/2001 sobre la "*Protección de la salud y la Seguridad de los trabajadores contra los riegos relacionados con los agentes químicos durante el trabajo",* el qual era complementat per la llei 34/2007 que estableix la normativa per la *"calidad del aire i la protección de la atmosfera"*.

La llei 34/2007 proposa una nova classificació i determinació dels contaminants per l'atmosfera, tal com es veu a la taula 5.4.2

Taula 5.2 Taula amb els principals riscs de contaminació atmosférica d'acord amb la llei 34/2007

Risc de contaminants de la planta de Freon-13	
Codi numèric	Activitat
04 04 15/04 05 22	Emmagatzemament i manipulació de productes químics
04 05 26	Producció de compostos orgànics persistents

La planta, a part, està inclosa en el Grup A d'activitats potencialment contaminadores de l'atmosfera, segons l'apartat IV de la llei 34/2007 -els punts en qüestió són el 1.6.3 producció d'halògens i els seus hidràcids i els processos que els emeten assíduament; 1.6.4 producció i ús de fluorurs; 1.6.5 producció de clorurs, oxiclorurs i sulfurs de carboni, sofre i fòsfor-.

Actualment la normativa que s'utilitza és la dictada per REACH amb el reglament Nº 1272/2008 sobre "*la clasificación, etiquetado y sobre clasificación, etiquetado y envasado de sustancias y mezclas".*

Les activitats del grup A impliquen l'estudi del procés per tal d'aconseguir l'autorització per part de la comunitat autònoma allà on s'instal·li la planta, de manera que es garanteixi que l'increment de contaminació està dins uns límits admissibles i es pugui donar permís per a la construcció i desenvolupament de l'activitat. Per tant, el Grup A exigeix controls d'emissió molt restrictius i específics, i les concessions es solen fer per 8 anys, després cal renovar l'estudi i concessió de l'autorització.

Finalment s'amplia la llista i especificació de la llei 34/2007 amb el Reial Decret 100/2011 on *" se actualiza el catálogo de actividades potencialmente contaminadores de la atmosfera y se establecen las disposiciones básicas para su aplicación"*, aconseguint així la definitiva llista de activitats contaminants que es duen a terme a la planta.

Taula 5.3 Activitats contaminants segons el Reial Decret 100/2011

Risc d'activitats contaminants atmosfèrics		
Codi numèric	Activitat	Grup
04 04 13 00	Producció de cloro-Cl. Producció de sosa o potassa	A
04 04 15 01/04 04 15 02	Emmagatzemament de productes inorgànics líquids o gasos amb capacitat >= 100m^3/Capacitat <100m^3	C
06 05 03 00	Equips de refrigeració o aire condicionat que utilitzen productes diferents als halocarburs	-

5.4.1 SEGURETAT CALDERA

Tal com es menciona en la ITP EP-1 publicada al BOE amb data 5 de febrer de 2009, una caldera es pot classificar en diferents tipus, els quals en determinen les mesures de seguretat requerides.

Per classificar les calderes primer s'ha de conèixer de quin tipus de caldera és, aquatubulars o pirotubulars.

En el cas de la planta de TAGO s'instal·len i operen calderes de la marca BOSCH del tipus universal U-MB. Es tracta d'un tipus de caldera estàndard pirotubular de tres passos i una llar, amb una capacitat de 2000 kg/h.

Un cop conegut el tipus de caldera, s'usa l'equació 5.1 per determinar si compleix amb els límits del tipus I o si per contra s'apliquen les mesures del tipus II.

$$Pms \cdot VT < 15000 \quad (eq. 5.1)$$

On Pms és la pressió màxima de servei en la instal·lació, i VT és el volum total en litres de la caldera.

Com no es troba dins del límit de l'equació la caldera instal·lada és de tipus II. Per tant, la seva instal·lació requereix d'unes instal·lacions alienes. Les condicions generals requereixen un espai mínim de 1 metre entre la paret de la sala. La ventilació de la sala haurà de ser la correcta, per tant ha d'existir una renovació constant suficient per complir amb els requeriments específics del combustible; la sala haurà d'estar neta, lliure de pols, gasos o vapors inflamables. No es podran realitzar tasques que no estiguin directament relacionades amb els aparells que hi ha a la sala, a demès existiran cartells de prohibició expressa de l'entrada a la sala de calderes a tota persona aliena als treballadors encarregats al servei de la caldera. Únicament es podran instal·lar elements que serveixin per al servei de la caldera. Per seguretat dins la sala de la caldera es tindrà una copia del manual del funcionament de les calderes instal·lades, així com els procediments d'actuació en cas d'emergència.

A part, com es tracta de calderes de tipus II s'hauran complir amb les condicions especifiques per al emplaçament de la caldera com poden ser:

- Les calderes han d'estar situades dins una sala amb com a mínim dos sortides de fàcil accés i en parets diferents

- Els dimensionaments de la sala hauran de complir una alçada mínima amb un metre per sobre de la part més alta de la caldera. A part, les parets han de ser de formigó armat, amb un mínim de 20 cm d'espessor.

Les obertures que es faran en els murs han de complir unes condicions especifiques:

- Les portes seran metàl·liques, de 2,5 metres d'alt per 1,6 d'ample.
- Les dimensions de com a mínim un accés haurà de ser de dimensions suficients per al pas d'equips i elements accessoris de la caldera.
- Les portes s'obriran en direcció de sortida de la sala, amb sistemes de fàcil apertura com les denominades manetes antipànic.
- Les obertures dels murs de protecció destinades a finestres estaran situades a un metre sobre el punt mes alt de pressió de la caldera.
- Totes les portes de ventilació situada davant del cremador amb una protecció amb un mòdul resistent amb la finalitat de poder resistir l'impacte d'aquest en cas d'accident.

Per altra banda els sostres de la sala de calderes haurà de complir amb unes condicions especifiques.

- Els sostres no hauran de ser mai inferiors a 3 metres des del nivell de terra, a més a més del metre com a mínim del punt més alt de la pressió de la caldera.
- El sostre del recinte haurà d'estar fet d'una construcció lleugera, amb una superfície mínima del 25% de la sala i no es podrà construir a sobre a no ser que s'instal·lin aparells complementaris a l'operació de la caldera com poden ser descalcificadors o depuradores de l'aigua d'alimentació.

5.5 SUBSTÀNCIES QUÍMIQUES

En aquest punt es pretén classificar les substancies, especificar el tipus d'envàs així com etiquetatge i les fitxes de seguretat del productes que es troben en els corrents de la planta. Per l'anàlisi dels compostos i per a l'etiquetatge, es segueix les normatives i referències del document de les nacions unides "*Sistema Globalmente Armonizado de clasificación y etiquetado de productos químicos (SGA)"*.L'edició que s'usa és la cinquena, que data del 2013. A continuació es fa un llistat de substàncies que s'usen a la planta i la funció que tenen:

- Reactius: Fluorur d'hidrogen anhidre, tetraclorur de carboni.
- Intermediaris: Freon-11, Freon-12.
- Productes:Freon-13.
- Catalitzadors: fluorur de cromil, triclorur d'alumini.
- Subproductes: Àcid clorhídric (30%).
- Serveis: nitrogen gas, propilè, aire comprimit, vapor d'aigua, aigua de torre.

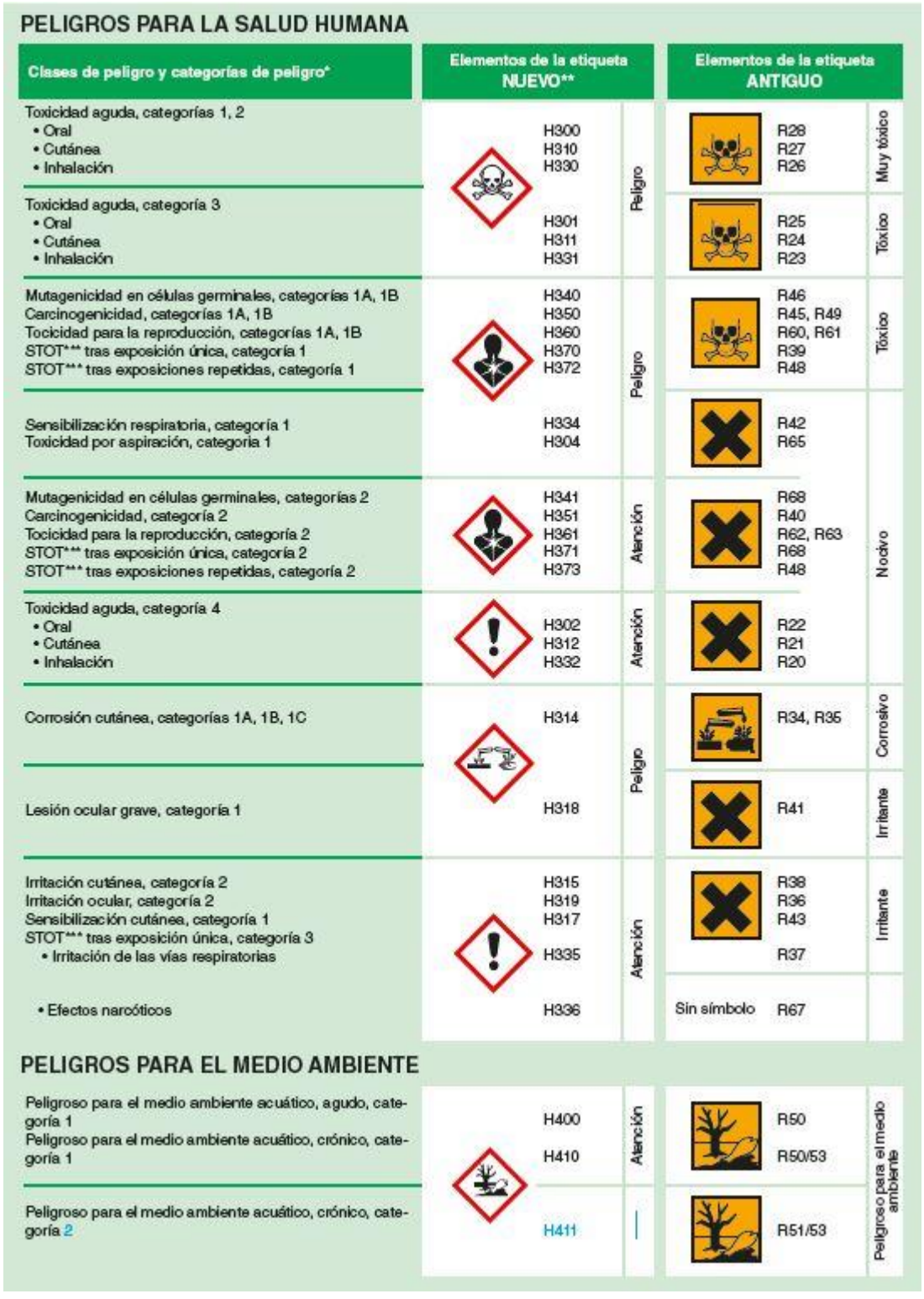
5.5.1 CLASSIFICACIÓ DE LES SUBSTÀNCIES QUÍMIQUES

Per a la classificació de les substancies s'utilitza la classificació de risc del SGA, que té en compte únicament les propietats intrínseques de la substància. Per a que sigui un mètode fàcil de visualitzar i alertar s'usen pictogrames tal com mostra la figura 5.1 i 5.2

PELIGROS FÍSICOS

Clases de peligro y categorías de peligro*	Elementos de la etiqueta NUEVO**		Elementos de la etiqueta ANTIGUO	
Explosivos • Explosivos inestables • Explosivos divisiones 1.1 a 1.3 Sustancias/mezclas que reaccionan expontáneamente, tipo A, B Peróxidos orgánicos, tipos A, B	 H200 H201, H202, H203 H240, H241 H240, H241	Peligro	 (R2, R3)	Peligro
Explosivos, división 1.4	 H204	Atención	Sin clasificación	
Gases inflamables, categoría 1 Aerosoles inflamables, categoría 1 Líquidos inflamables, categoría 1	 H220 H222 H224	Atención / Peligro	 (R12) (R12) R12	Extremadamente inflamable
Líquidos inflamables, categoría 2 Sólidos inflamables, categoría 1 Sólidos inflamables, categoría 2	H225 H228 H228		 R11 (R11) (R11)	Fácilmente inflamable
Aerosoles inflamables, categoría 2 Líquidos inflamables, categoría 3	 H223 H226	Atención	Sin símbolo (R10) R10 Sin clasificación. Punto de inflamación 56-60ºC	Inflamable
Líquidos pirofóricos, categoría 1 Sólidos piroforícos, categoría 1 Sustancias/mezclas que, en contacto con el agua, desprenden gases inflamables, categorías 1, 2 y categoría 3	H250 H250 H260 H261 H261	Atención / Peligro	 R17 R17 (R15) (R15) (R15)	Fácilmente inflamable
Sustancias/mezclas que reaccionan espontáneamente, tipo B Sustancias/mezclas que reaccionan espontáneamente, tipos C y D y tipos E y F Sustancias/mezclas que experimentan calentamiento espontáneo, categoría 1 y categoría 2	 H241 H242 H242 H251 H252		 R12 R12	Fácilmente inflamable
Peróxidos orgánicos, tipo B Peróxidos orgánicos, tipos C y D Peróxidos orgánicos, tipos E y F	H241 H242 H242		 R7 R7	Comburente
Gases comburentes, categoría 1 Líquidos comburentes, categorías 1 y 2 y categoria 3 Sólidos comburentes, categorías 1 y 2 y categoria 3	 H270 H271, H272 H272 H271, H272 H272	Peligro/Atención	 R8 R8, R9 R8, R9	Comburente
Gases a presión • Gas comprimido • Gas licuado • Gas licuado refrigerado • Gas disuelto	 H280 H280 H281 H280	Atención	Sin clasificación	
Sustancias/mezclas corrosivas para los metales, categoría 1	 H290	Atención	Sin clasificación	

Figura 5.1 Pictogrames SGA sobre perills físics.



PELIGROS PARA LA SALUD HUMANA

Clases de peligro y categorías de peligro*	Elementos de la etiqueta NUEVO**		Elementos de la etiqueta ANTIGUO	
Toxicidad aguda, categorías 1, 2 • Oral • Cutánea • Inhalación	H300 H310 H330	Peligro	R28 R27 R26	Muy tóxico
Toxicidad aguda, categoría 3 • Oral • Cutánea • Inhalación	H301 H311 H331	Peligro	R25 R24 R23	Tóxico
Mutagenicidad en células germinales, categorías 1A, 1B Carcinogenicidad, categorías 1A, 1B Tocicidad para la reproducción, categorías 1A, 1B STOT*** tras exposición única, categoría 1 STOT*** tras exposiciones repetidas, categoría 1	H340 H350 H360 H370 H372	Peligro	R46 R45, R49 R60, R61 R39 R48	Tóxico
Sensibilización respiratoria, categoría 1 Toxicidad por aspiración, categoría 1	H334 H304	Peligro	R42 R65	Nocivo
Mutagenicidad en células germinales, categorías 2 Carcinogenicidad, categoría 2 Tocicidad para la reproducción, categoría 2 STOT*** tras exposición única, categoría 2 STOT*** tras exposiciones repetidas, categoría 2	H341 H351 H361 H371 H373	Atención	R68 R40 R62, R63 R68 R48	
Toxicidad aguda, categoría 4 • Oral • Cutánea • Inhalación	H302 H312 H332	Atención	R22 R21 R20	
Corrosión cutánea, categorías 1A, 1B, 1C	H314	Peligro	R34, R35	Corrosivo
Lesión ocular grave, categoría 1	H318	Peligro	R41	Irritante
Irritación cutánea, categoría 2 Irritación ocular, categoría 2 Sensibilización cutánea, categoría 1 STOT*** tras exposición única, categoría 3 • Irritación de las vías respiratorias	H315 H319 H317 H335	Atención	R38 R36 R43 R37	Irritante
• Efectos narcóticos	H336	Atención	Sin símbolo R67	

PELIGROS PARA EL MEDIO AMBIENTE

Peligroso para el medio ambiente acuático, agudo, categoría 1 Peligroso para el medio ambiente acuático, crónico, categoría 1	H400 H410	Atención	R50 R50/53	Peligroso para el medio ambiente
Peligroso para el medio ambiente acuático, crónico, categoría 2	H411		R51/53	Peligroso para el medio ambiente

Figura 5.2 Pictogrames SGA sobre perills físics per a la seguretat.

5.5.2 ENVASAT I ETIQUETAT

Cada substància ha de ser etiquetada i envasada correctament, tal com es menciona en el Reial Decret 363/1995 el qual també especifica que l'etiquetatge ha de definir ràpidament les característiques de la substància continguda.

Addicionalment, el reglament nº 1272/2008 del parlament europeu disposa en el capítol 1, articles 5 i 6, sobre la identificació i exàmens de la informació disponible sobre les substancies i mescles, respectivament, quines dades i informació cal conèixer al treballar. Mentre que al article 17 del capítol referent al contingut que ha d'aportar l'etiqueta, identifica la normativa general que han de figurar:

- Nom, direcció i numero de telèfon del proveïdor.
- Identificadors del producte.
- Quantitat nominal de la substància o mescla que està continguda a l'envàs, que siguin fàcilment identificables i a disposició del públic, a no ser que la quantitat ja estigui especificada en algun altre lloc de l'envàs.
- Els pictogrames de perill de les figures 5.5.1 i 5.5.2 abans mostrats en cas de procedir.
- Paraules de perill segons l'article 20.
- Si escau les indicacions de perill segons l'article 21.
- Els consells de prudència a l'hora de la manipulació dels productes segons l'article 22.
- Una secció suplementària la qual aporti tota la informació llistada a l'article 25.

Finalment, l'etiqueta ha d'estar escrita en la llengua/llengües oficials de l'estat on es comercialitza, a no ser que l'estat interessat disposi un altre cosa.

Artículo 20

Palabras de advertencia

1. En la etiqueta figurará la palabra de advertencia correspondiente de conformidad con la clasificación de la sustancia o mezcla peligrosa.

2. La palabra de advertencia correspondiente a cada clasificación específica queda establecida en las tablas de las partes 2 a 5 del anexo I que indican los elementos que deben figurar en las etiquetas para cada clase de peligro.

3. Cuando en la etiqueta figure la palabra de advertencia «peligro», no aparecerá la palabra de advertencia «atención».

Artículo 21

Indicaciones de peligro

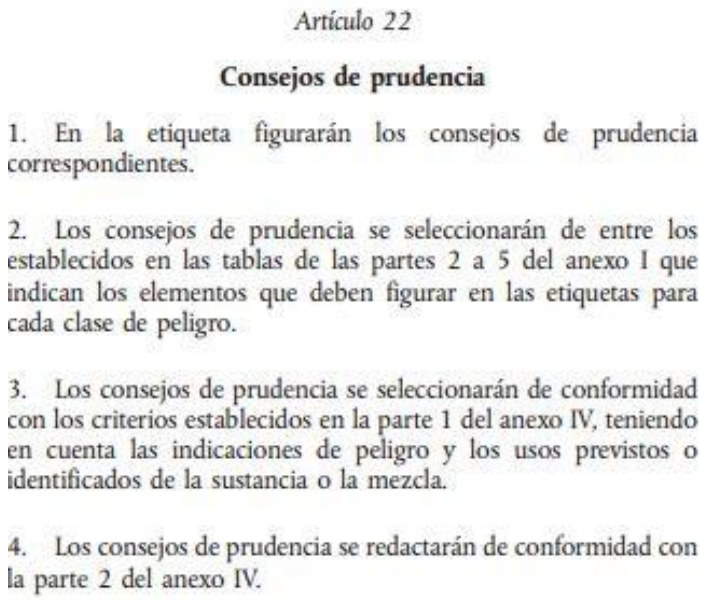
1. En la etiqueta figurarán las indicaciones de peligro correspondientes de conformidad con la clasificación de la sustancia o mezcla peligrosa.

2. Las indicaciones de peligro correspondientes a cada clasificación quedan establecidas en las tablas de las partes 2 a 5 del anexo I que indican los elementos que deben figurar en las etiquetas para cada clase de peligro.

3. Cuando una sustancia figure en la parte 3 del anexo VI, se usará en la etiqueta la indicación de peligro correspondiente a cada clasificación específica cubierta por la entrada de dicha parte, junto con las indicaciones de peligro a que se refiere el apartado 2 para cualquier otra clasificación que no esté cubierta por la entrada en cuestión.

4. Las indicaciones de peligro se redactarán de conformidad con el anexo III.

Figura 5.3 Imatge on es mostren els articles necessaris pel correcte etiquetatge segons el reglament 1272/2008.



Artículo 22

Consejos de prudencia

1. En la etiqueta figurarán los consejos de prudencia correspondientes.

2. Los consejos de prudencia se seleccionarán de entre los establecidos en las tablas de las partes 2 a 5 del anexo I que indican los elementos que deben figurar en las etiquetas para cada clase de peligro.

3. Los consejos de prudencia se seleccionarán de conformidad con los criterios establecidos en la parte 1 del anexo IV, teniendo en cuenta las indicaciones de peligro y los usos previstos o identificados de la sustancia o la mezcla.

4. Los consejos de prudencia se redactarán de conformidad con la parte 2 del anexo IV.

Figura 5.4 Article 22 sobre el correcte etiquetat, reglament 1272/2008

L'article 25 està format per 6 punts en els quals s'inclouen la informació de l'apartat d'informació suplementària de l'etiqueta, entre els quals s'han de incloure els consells de prudència, quan la substància o mescla tingui propietats físiques amb efectes sobre la salut humana; els consells de seguretat si la mescla està classificada com a perillosa segons la directiva 91/414/CEE.; informació addicional que afegirà el proveïdor sense que es dificulti la identificació dels elements obligatoris de l'article 17; no s'hauran d'incloure indicacions si la substància no és perillosa, és a dir, han de ser conseqüents amb la classificació; el pictograma de perill.

5.5.2.1 Frases R i S

Les frases R i S es troben a l'envàs de cada substància i s'han d'incloure a la fitxa de seguretat de cada una d'elles, permeten així una ràpida identificació dels riscos que presenten.

5.5.2.1.1. Frases R simples aplicades

- Nocivo por inhalación.
- Nocivo en contacto con la piel.
- Nocivo por ingestión.
- Tóxico por inhalación.

- Tóxico en contacto con la piel.
- Tóxico por ingestión.
- Provoca quemaduras.
- Provoca quemaduras graves.
- Irrita los ojos.
- Irrita las vías respiratorias.
- Irrita la piel.
- Puede provocar a largo plazo efectos negativos en el medio ambiente.
- Peligroso para la capa de ozono.

5.5.2.1.1. Frases R combinades aplicades

- Nocivo por inhalación, por ingestión y en contacto con la piel.
- Muy tóxico por inhalación, por ingestión y en contacto con la piel.

5.5.2.1.1. Frases S simples aplicades

- Manténgase fuera del alcance de los niños.
- Manténgase el recipiente bien cerrado.
- Conservar alejado del calor.
- No respirar los gases/humos/vapores/aerosoles [denominación(es) adecuada(s) a especificar por el fabricante].
- Evítese el contacto con la piel.
- Evítese el contacto con los ojos.
- No tirar los residuos por el desagüe
- Úsese indumentaria protectora adecuada.
- Úsense guantes adecuados.
- Evítese su liberación al medio ambiente. Recábense instrucciones específicas de la ficha de datos de seguridad.

5.5.2.1.1. Frases S combinades aplicades

- Evítese el contacto con los ojos y la piel.
- No tirar los residuos por el desagüe; elimínense los residuos del producto y sus recipientes con todas las precauciones posibles.
- Úsense indumentaria y guantes adecuados y protección para los ojos/la cara.

5.5.3 FITXES DE SEGURETAT DE LES SUBSTÀNCIES

- **Àcid fluorhídric**

Honeywell

Material Safety Data Sheet

HYDROFLUORIC ACID, ANHYDROUS

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Hydrofluoric Acid, Anhydrous

OTHER/GENERIC NAMES: HF, Anhydrous HF, AHF, Hydrogen Fluoride, HF Acid

PRODUCT USE: Chemical Derivatives, Alkylation Catalyst

MANUFACTURER: Honeywell International
Industrial Fluorines
101 Columbia Road
Box 1053
Morristown, New Jersey 07962-1053

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-4:30pm EST)
HF Technical Service Department
800-622-5002
Or visit the Honeywell HF website:
http://www.HFacid.com

IN CASE OF EMERGENCY CALL:
(24 Hours/Day, 7 Days/Week)
800-707-4555 or 602-365-4980
For Transportation Emergencies
800-424-9300 (CHEMTREC for US)
613-996-6666 (CANUTEC for Canada)

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
Hydrofluoric Acid	7664-39-3	100

Trace impurities and additional material names not listed above may also appear in the Regulatory Information Section 15 towards the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Clear, colorless, corrosive fuming liquid with an extremely acrid odor. Forms dense white vapor clouds if released. Both liquid and vapor can cause severe burns to all parts of the body. Specialized medical treatment is required for all exposures.

Honeywell

MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

POTENTIAL HEALTH HAZARDS

SKIN: Both liquid and vapor can cause severe burns, which may not be immediately painful or visible. HF will penetrate skin and attack underlying tissues. Large or multiple burns totaling over 25 square inches of body surface area may also cause hypocalcemia (depletion of calcium in the body) and other toxic effects which may be fatal. Prolonged contact with very dilute HF solutions will cause burns

EYES: Both liquid and vapor can cause irritation or corneal burns.

INHALATION: **Mild exposure**: Can irritate nose, throat and respiratory system. Onset of symptoms may be delayed for several hours.

Severe exposure: Can cause nose and throat burns, lung inflammation and pulmonary edema (fluid in the lungs). Also results in other toxic effects including hypocalcemia (depletion of calcium in the body) which if not properly treated can result in death.

INGESTION: Can cause severe mouth, throat and stomach burns and may be fatal if swallowed. Even with small amounts of dilute solutions, profound and possibly fatal hypocalcemia (depletion of calcium in body) and systematic toxicity is likely to occur unless medical treatment is promptly initiated.

DELAYED EFFECTS: The effects of contact with dilute solutions of hydrofluoric acid or its vapors may be delayed. The potential delay in clinical signs or symptoms for dilute solutions is given below. Symptoms might include pain, redness of the skin and possible tissue destruction.

HF Concentration	Delay in Symptoms
>50%	Immediately Apparent
20%-50%	1-8 hours
0%-20%	Up to 24 hours

Can also cause bone and joint changes in humans (Fluorosis).

Carcinogenicity: Hydrofluoric Acid is not listed by NTP, IARC, OSHA, US EPA, ACGIH, or Health Canada as a carcinogen.

4. FIRST AID MEASURES

SKIN: Remove the victim from the contaminated area and immediately wash the burned area with plenty of water for a minimum of 15 minutes. Limit washing to 5 minutes if treatment specific for HF exposure is available. Remove all contaminated clothing while washing continuously. After thorough washing for at least 5 minutes, the burned area should be immersed in a solution of 0.13% iced aqueous Zephiran® Chloride until pain is relieved. As an alternate first aid treatment, 2.5% calcium gluconate gel may be continuously massaged into the burn area until the pain is relieved. For larger burns or burns treated with calcium gluconate gel (in which pain is present longer than 30 minutes), a physician should inject 5% aqueous calcium gluconate beneath, around and in the burned area. Use of local anesthetics is not recommended, as reduction in pain is an indicator of effectiveness of treatment.

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MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

EYES: Irrigate eyes for at least 15 minutes with copious quantities of water, keeping eyelids apart and away from eyeballs during irrigation. Get competent medical attention immediately, preferably an eye specialist. If a physician is not immediately available, apply one or two drops of 0.5% tetracaine hydrochloride solution, or other aqueous, topical ophthalmic anesthetic and continue irrigation. Do not use the solution described for skin treatment. Use no other medications unless instructed to do so by a physician. Rubbing of the eyes is to be avoided. Irrigate with 1% calcium gluconate in normal saline for 1 to 2 hours to prevent or lessen corneal damage.

INHALATION: Move to fresh air. Keep the victim lying down, quiet and warm. Get competent medical attention immediately. If breathing has stopped, start artificial respiration at once. An authorized person should administer oxygen to a victim who is having difficulty breathing, until the victim is able to breathe easily by himself. Calcium Gluconate, 2.5% in normal saline may be given by nebulizer with oxygen. Do not give stimulants unless instructed to do so by a physician. Victim should be examined by a physician and held under observation for at least 24 hours.

INGESTION: Drink large amounts of water to dilute. Do not induce vomiting. Several glasses of milk or several ounces of milk of magnesia may be given for their soothing effect. Take victim to a doctor.

ADVICE TO PHYSICIAN: For large skin area burns (totaling greater than 25 square inches), for ingestion and for significant inhalation exposure, severe systemic effects may occur. Monitor and correct for hypocalcemia, cardiac arrhythmias, hypomagnesemia and hyperkalemia. In come cases hemodialysis may be indicated. For certain burns, especially of the digits, use of intra-arterial calcium gluconate may be indicated. For inhalation exposures, treat as chemical pneumonia. Monitor for hypocalcemia. 2.5% calcium gluconate in normal saline by nebulizer or by IPPB with 100% oxygen may decrease pulmonary damage. Bronchodilators may also be administered.
A booklet titled "Recommended Medical Treatment for Hydrofluoric Acid Exposure" is available from the Honeywell HF website: http://www.HFacid.com

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT: Not flammable
FLASH POINT METHOD: Closed cup
AUTOIGNITION TEMPERATURE: Not applicable
UPPER FLAME LIMIT (volume % in air): Not applicable
LOWER FLAME LIMIT (volume % in air): Not applicable
FLAME PROPAGATION RATE (solids): Not applicable
OSHA FLAMMABILITY CLASS: Not applicable

EXTINGUISHING MEDIA:
Use water or suitable agent for fires adjacent to non-leaking tanks or containers of HF. Do not use solid water streams near ruptured tanks or spills of HF. Acid reacts with water and can splatter acid onto personnel.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Reaction with certain metals generates flammable and potentially explosive hydrogen gas. Considerable heat is evolved when contacted with many substances. Heat increases pressure and may explode container. Will react violently with water.

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MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Wear self-contained breathing apparatus approved by NIOSH and full chemical protective clothing. Use water spray to keep containers cool.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (Always wear recommended personal protective equipment)

Good ventilation is necessary. Discharge will ordinarily be a vapor or a liquid that gives off fumes of HF gas. Those treating spills or repairing leaks must use full protective equipment. Take actions to minimize environmental impact. Try to contain spillage and avoid drainage to areas which cannot be treated. Rapid dilution of the spill with water to <50% will reduce the amount of fumes given off. Carefully neutralize the dilute liquid with lime slurry, soda ash, limestone, caustic soda or other alkaline material. (See Sections 10 and 13 for more information.)

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)

Do not breathe vapor or mist. Use only with adequate ventilation. Avoid all contact with skin, eyes and clothing, even dilute solutions. Do not add water to acid.

STORAGE RECOMMENDATIONS:

Store in approved containers only. Store in cool, well-ventilated area. Flammable hydrogen gas can be generated in metal storage containers. Diking of storage tanks is recommended. Carbon steel in HF service may be subject to indiscriminate hydrogen blistering and possibly other hydrogen related damage and should, therefore, be routinely inspected and repaired if needed. Non-destructive tank thickness testing (NDT), and other techniques should be utilized for periodic checks of tank wall thickness and to assure equipment integrity.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

Sufficient to reduce vapor and acid mists below permissible TLV levels. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION:

For routine product use, wear hydrofluoric acid-resistant jacket, trousers, boots and gauntlet gloves. For increased protection, use air-supplied totally encapsulating HF resistant protective suit.

EYE PROTECTION:

As a minimum, wear hard hat, chemical safety goggles (plastic lenses), and full face plastic shield. For increased protection, use air supplied hydrofluoric acid resistant hood.

RESPIRATORY PROTECTION:

Where required, use a respirator approved by NIOSH for HF gas or mists, as applicable. Some exposures may require a NIOSH-approved, self-contained breathing apparatus or air supplied respirator.

ADDITIONAL RECOMMENDATIONS:

Eyewash and quick-drench shower facilities, protected from freezing, should be available where HF is stored or handled.

Honeywell

MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

EXPOSURE GUIDELINES **(Guidelines exist for the following ingredients)**

INGREDIENT NAME	ACGIH TLV	OSHA PEL	OTHER LIMIT
Hydrofluoric acid	3 ppm – CEILING	3 ppm (TWA)	3 mg(F)/g creatinine in urine pre-shift 10 mg(F)/g creatinine post-shift***

OSHA STEL	IDLH
6 ppm (15 min.)	30 ppm

AIHA Emergency Response Planning Guideline

ERPG-1	ERPG-2	ERPG-3
2 ppm (60 mins)	20 ppm (60 mins)	50 ppm (60 mins)
2 ppm (10 mins)	50 ppm(10 mins)	170 ppm (10 mins)

*** = Biological Exposure Index

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS: None

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless liquid, fumes in air
PHYSICAL STATE: Liquid
MOLECULAR WEIGHT 20.01
CHEMICAL FORMULA HF
ODOR Sharp pungent odor
SPECIFIC GRAVITY (Water = 1.0) 0.97 at 70°F (21.1°C)
SOLUBILITY IN WATER (Weight %) 100% by weight
pH: Not applicable
BOILING POINT: 67.2°F (19.54°C)
MELTING POINT: -118°F (-84°C)
VAPOR PRESSURE: 776 mm Hg at 70°F (21°C)
VAPOR DENSITY (Air = 1.0): 2.21 @ 70°F, 1.76 @ 80°F
EVAPORATION RATE: Not applicable
% VOLATILES: 100
IONIZATION POTENTIAL: 15.98 eV
FLASH POINT: Not flammable.
(Flash point method and additional flammability data are found in section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID): Stable under normal conditions.

INCOMPATIBILITIES:
Glass, concrete and other silicon bearing materials: yield silicon tetrafluoride gas. Pressure buildup from this process has been known to rupture glass containers. Carbonates, sulfides and cyanides: yield toxic gases: carbon dioxide, hydrogen sulfide and hydrogen cyanide. Alkalis, some oxides: cause strong violent exothermic reactions. Common metals: yield hydrogen gas, a fire and explosive reactive hazard. Corrosive to many materials including leather, natural rubber and many organics. Considerable heat is evolved and a violent reaction can occur when water is added to HF.

Honeywell

MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

HAZARDOUS DECOMPOSITION PRODUCTS: Not applicable; boils away unchanged.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

Inhalation:	LC_{50} (Rat)	=	5,100 ppm/5 min
	LC_{50} (Rat)	=	1,300 ppm/60 min
	LC_{50} (Mouse)	=	6,247 ppm/5 min

Skin: 2% solution of HF was corrosive to rabbit skin with 1 hour exposure, but not with 1 minute exposure.

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Prolonged exposure can cause bone and joint changes in humans. (Fluorosis – Increased bone density and mottling of teeth.)

OTHER DATA: None

12. ECOLOGICAL INFORMATION

Aquatic toxicity: 60 ppm/*/fish/lethal/fresh water. (*time period not specified).

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Yes
If yes, the RCRA ID number is: U134 (hydrofluoric acid) and D002 (Corrosive)

OTHER DISPOSAL CONSIDERATIONS: As waste disposal methods may vary, contact the supplier for specific recommendations. Treat small amounts by adding to an excess of water and neutralize with a lime slurry, soda ash, limestone, caustic soda or other alkali. Add to water and neutralize cautiously as reaction is immediate and can be violent. Considerable amounts of harmful vapors may be released. Good ventilation is required. Dispose of residue (or slurry) by removal to an approved chemical waste landfill or by an approved waste contractor.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT HAZARD CLASS: CLASS 8 (CORROSIVE), PACKING GROUP, PG I,
POISON – INHALATION HAZARD, HAZARD ZONE C

PROPER SHIPPING NAME: RQ, HYDROGEN FLUORIDE, ANHYDROUS (for quantities greater than 100 lbs.)
US DOT ID NUMBER: UN 1052
For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

Honeywell

MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Hydrofluoric Acid, Anhydrous is listed.

OTHER TSCA ISSUES: None

SARA TITLE III/CERCLA:
RQs and TPQs:
"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME	SARA/CERCLA RQ (lbs)	SARA EHS TPQ (lbs)
Hydrofluoric Acid	100	100

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center (800-424-8802) and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: Immediate. Delayed
SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME	COMMENT
Hydrofluoric Acid	None

STATE RIGHT-TO-KNOW

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

INGREDIENT NAME	WEIGHT %	COMMENT
No ingredients in this section		

ADDITIONAL REGULATORY INFORMATION:

Storage or in process use greater than the specified threshold quantity of 1000 lbs. is subject to OSHA 29 CFR Part 1910.119, Process Safety Management of Highly Hazardous Chemicals, and
EPA 40 CFR Part 68, Section 112(r)7 Accidental Release Prevention Requirements: Risk Management Programs.

WHMIS CLASSIFICATION (CANADA):

Class D, Division 1, Subdivision A and
Class E

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

FOREIGN INVENTORY STATUS:

Canadian DSL (Domestic Substances List)
EINECS (European Inventory of Existing Chemical Substances) (EINECS #:231-634-8)

Honeywell

MATERIAL SAFETY DATA SHEET

Hydrofluoric Acid, Anhydrous

16. OTHER INFORMATION

CURRENT ISSUE DATE: January, 2003
PREVIOUS ISSUE DATE: January, 2002

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:

Added reference to the Honeywell HF website as a resource for further information about Hydrogen Fluoride/Hydrofluoric acid. Minor wording changes for clarification made in Sections 1,3,4,10,14. Added AIHA ERPG 10 minute levels in Section 8. Removed reference to the Hazardous Materials Information System (HMIS) rating, (under "Other Information" on Page 8 of 8) due to March 2002 changes in how these ratings are assessed. (Jan '03)

OTHER INFORMATION: National Fire Prevention Association (NFPA) Rating
Health 4, Flammability 0, Reactivity 1, Special Instruction – None

- **Tetraclorur de carboni**

MATHESON TRI•GAS
ask. . .The Gas Professionals™

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: CARBON TETRACHLORIDE

TRADE NAMES/SYNONYMS:
CARBON CHLORIDE (CCl4); PERCHLOROMETHANE; TETRACHLOROMETHANE; BENZINOFORM; RCRA U211; R 10 (REFRIGERANT); UN 1846; CCl4; MAT04310; RTECS FG4900000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989
REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: CARBON TETRACHLORIDE
CAS NUMBER: 56-23-5
PERCENTAGE: 100

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=1 REACTIVITY=0

EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: liquid
ODOR: distinct odor
MAJOR HEALTH HAZARDS: central nervous system depression, suspect cancer hazard (in animals)

POTENTIAL HEALTH EFFECTS:
INHALATION:
SHORT TERM EXPOSURE: irritation, digestive disorders, headache, drowsiness, dizziness, loss of coordination, lung congestion, effects on the brain, convulsions, coma

LONG TERM EXPOSURE: irritation, digestive disorders, headache, drowsiness, dizziness, loss of coordination, visual disturbances, lung congestion, kidney damage, liver damage, reproductive effects, effects on the brain, convulsions, coma, cancer
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation, rash, absorption may occur, digestive disorders, headache, drowsiness, dizziness, loss of coordination, lung congestion, effects on the brain, convulsions, coma
LONG TERM EXPOSURE: visual disturbances, kidney damage, liver damage, reproductive effects, cancer
EYE CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: no information is available
INGESTION:
SHORT TERM EXPOSURE: irritation, digestive disorders, headache, drowsiness, dizziness, loss of coordination, lung congestion, effects on the brain, convulsions, coma
LONG TERM EXPOSURE: kidney damage, liver damage, cancer

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If swallowed, drink plenty of water, do NOT induce vomiting. Get immediate medical attention. Induce vomiting only at the instructions of a physician. Do not give anything by mouth to unconscious or convulsive person.

NOTE TO PHYSICIAN: For ingestion, consider gastric lavage.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Slight fire hazard.

EXTINGUISHING MEDIA: regular dry chemical, regular foam, water

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Fight large fires from a protected location or safe distance. Stay away from the ends of tanks. Dike for later disposal. Do not scatter

spilled material with high-pressure water streams. Do not attempt to extinguish fire unless flow of material can be stopped first. Use extinguishing agents appropriate for surrounding fire. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Consider downwind evacuation if material is leaking.

FLASH POINT: not flammable

6. ACCIDENTAL RELEASE MEASURES

AIR RELEASE:
Reduce vapors with water spray. Stay upwind and keep out of low areas.

SOIL RELEASE:
Trap spilled material at bottom in deep water pockets, excavated holding areas or within sand bag barriers. Dike for later disposal. Absorb with sand or other non-combustible material. Collect with absorbent into suitable container.

WATER RELEASE:
Trap spilled material at bottom in deep water pockets, excavated holding areas or within sand bag barriers. Remove trapped material with suction hoses. Absorb with activated carbon. Collect spilled material using mechanical equipment. Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:
Do not touch spilled material. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Small dry spills: Move containers away from spill to a safe area. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Protect from physical damage. Store in a cool, dry place. Store in a well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
CARBON TETRACHLORIDE:
10 ppm OSHA TWA
25 ppm OSHA ceiling
200 ppm OSHA peak (5 minutes in any 4 hours)
2 ppm (12.6 mg/m3) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)
5 ppm ACGIH TWA (cutaneous absorption danger)
10 ppm ACGIH STEL (cutaneous absorption danger)
2 ppm (12.6 mg/m3) NIOSH recommended STEL 60 minute(s)

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
At any detectable concentration -
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Escape -
Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
APPEARANCE: clear
COLOR: colorless
ODOR: distinct odor
MOLECULAR WEIGHT: 153.82

MOLECULAR FORMULA: C-Cl4
BOILING POINT: 171 F (77 C)
FREEZING POINT: -9 F (-23 C)
VAPOR PRESSURE: 91.3 mmHg @ 20 C
VAPOR DENSITY (air=1): 5.32
SPECIFIC GRAVITY (water=1): 1.5940
WATER SOLUBILITY: 0.08% @ 20 C
PH: Not available
VOLATILITY: 100%
ODOR THRESHOLD: 50 ppm
EVAPORATION RATE: 12.8 (butyl acetate=1)
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Soluble: alcohol, benzene, chloroform, ether, carbon disulfide, petroleum ether, naphtha, acetone, fixed & volatile oils

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: combustible materials, metal salts, peroxides, halogens, oxidizing materials, metals, bases, amines

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

CARBON TETRACHLORIDE:
IRRITATION DATA: 4 mg skin-rabbit mild; 500 mg/24 hour(s) skin-rabbit mild; 2200 ug/30 second(s) eyes-rabbit mild; 500 mg/24 hour(s) eyes-rabbit mild
TOXICITY DATA: 8000 ppm/4 hour(s) inhalation-rat LC50; >20 gm/kg skin-rabbit LD50; 2350 mg/kg oral-rat LD50
CARCINOGEN STATUS: NTP: Anticipated Human Carcinogen; IARC: Animal Sufficient Evidence, Human Inadequate Evidence, Group 2B; ACGIH: A2 -Suspected Human Carcinogen; EC: Category 3
ACUTE TOXICITY LEVEL:
Moderately Toxic: ingestion
Slightly Toxic: inhalation, dermal absorption
TARGET ORGANS: central nervous system, liver, kidneys

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: history of alcoholism, alcoholism
TUMORIGENIC DATA: Available.
MUTAGENIC DATA: Available.
REPRODUCTIVE EFFECTS DATA: Available.
ADDITIONAL DATA: May cross the placenta. May be excreted in breast milk. Alcohol may enhance the toxic effects. Stimulants such as epinephrine may induce ventricular fibrillation.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: 43100 ug/L 96 hour(s) LC50 (Mortality) Fathead minnow (Pimephales promelas)

INVERTEBRATE TOXICITY: 1500 ug/L 7 hour(s) EC50 (Regeneration) Flatworm (Dugesia japonica)

ALGAL TOXICITY: >136000 ug/L NR hour(s) EC10 (Population Growth) Green algae (Haematococcus pluvialis)

OTHER TOXICITY: 900 ug/L 8 hour(s) EC50 (Teratogenesis) Leopard frog (Rana pipiens)

FATE AND TRANSPORT:
BIOCONCENTRATION: 30 ug/L 1-21 hour(s) BCF (Residue) Bluegill (Lepomis macrochirus) 52.3 ug/L

ENVIRONMENTAL SUMMARY: Moderately toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U211. Hazardous Waste Number(s): D019. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.5 mg/L.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Carbon tetrachloride
ID NUMBER: UN1846
HAZARD CLASS OR DIVISION: 6.1
PACKING GROUP: II
LABELING REQUIREMENTS: 6.1
MARINE POLLUTANT: CARBON TETRACHLORIDE

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Carbon tetrachloride
UN NUMBER: UN1846

CLASS: 6.1
PACKING GROUP/CATEGORY: II

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
Carbon tetrachloride: 10 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):
ACUTE: Yes
CHRONIC: Yes
FIRE: No
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
Carbon tetrachloride

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65:
Known to the state of California to cause the following:
Carbon tetrachloride
Cancer (Oct 01, 1987)

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: Not determined.

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

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16. OTHER INFORMATION

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- **Fluorur de cromil**

  Com no s'han trobat dades de seguretat del catalitzador que s'usa a la planta, és suposa que tindrà propietats similars a les del clorur de cromil, ja que els grups funcionals són similars exceptuant un element i degut que la ordenació que va proposar mendeléiev en la que cada grup(columna) tenen propietats similars.

Chromyl chloride

sc-268717

Material Safety Data Sheet

Hazard Alert Code Key: EXTREME | HIGH | MODERATE | LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Chromyl chloride

STATEMENT OF HAZARDOUS NATURE
CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA

SUPPLIER
Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800

EMERGENCY
ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

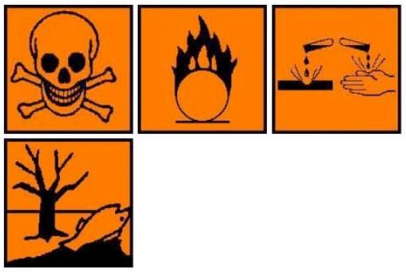
SYNONYMS
Cl2-Cr-O2, "chromium, dichlorodioxo-", dichlorodioxochromium, "chlorochromic anhydride", "chromium chloride oxide", "chromium dichloride dioxide", "chromium (VI) dioxychloride", "chromyl chloride", chromooxychloride, dioxodichlorochromium

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability:	0		
Toxicity:	2		
Body Contact:	4		
Reactivity:	2		
Chronic:	3		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK

Contact with combustible material may cause fire.
Causes severe burns.
Risk of serious damage to eyes.
May cause CANCER by inhalation.
May cause SENSITISATION by skin contact.
May cause heritable genetic damage.
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ The material can produce severe chemical burns within the oral cavity and gastrointestinal tract following ingestion.
■ Ingestion of acidic corrosives may produce burns around and in the mouth.
the throat and esophagus.
■ The material has NOT been classified as "harmful by ingestion".
This is because of the lack of corroborating animal or human evidence.
■ Symptoms of exposure may be delayed.

EYE

■ The material can produce severe chemical burns to the eye following direct contact. Vapors or mists may be extremely irritating.
■ If applied to the eyes, this material causes severe eye damage.
■ Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns.
Mild burns of the epithelia generally recover rapidly and completely.

SKIN

■ The material can produce severe chemical burns following direct contactwith the skin.
■ Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
■ Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects.
Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

■ The material can cause respiratory irritation in some persons.
The body's response to such irritation can cause further lung damage.
■ Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage.
There may be dizziness, headache, nausea and weakness.
■ Not normally a hazard due to non-volatile nature of product.
■ Chlorine vapour is extremely irritating to the upper respiratory tract and lungs Symptoms of exposure to chlorine include coughing, choking, breathing difficulty, chest pain, headache, vomiting, pulmonary oedema.
Inhalation may cause lung congestion, bronchitis and loss of consciousness.
■ Hydrogen chloride (HCl) vapour or fumes present a hazard from a single acute exposure.
Exposures of 1300 to 2000 ppm have been lethal to humans in a few minutes.

CHRONIC HEALTH EFFECTS

■ Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs.
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.
Skin contact with the material is more likely to cause a sensitization reaction in some persons compared to the general population.
Based on experiments and other information, there is ample evidence to presume that exposure to this material can cause genetic defects that can be inherited.
Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
There is some evidence that inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population.
Reduced respiratory capacity may result from chronic low level exposure to chlorine gas. Chronic poisoning may result in coughing, severe chest pains, sore throat and haemoptysis (bloody sputum). Moderate to severe exposures over 3 years produced decreased lung capacity in a number of workers.
Delayed effects can include shortness of breath, violent headaches, pulmonary oedema and pneumonia.
Amongst chloralkali workers exposed to mean concentrations of 0.15 ppm for an average of 10.9 years a generalised pattern of fatigue (exposures of 0.5 ppm and above) and a modest increased incidence of anxiety and dizziness were recorded. Leukocytosis and a lower haematocrit showed some relation to exposure.
Chronic minor exposure to hydrogen chloride (HCl) vapour or fume may cause discolouration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.

Repeated exposures of animals to concentrations of about 34 ppm HCl produced no immediate toxic effects.
Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.
Repeated or prolonged exposure to dilute solutions of HCl may cause dermatitis.
Chronic inhalation exposure may result in nasal ulceration and/orperforation of nasal septum.
Chromium(III) is an essential trace mineral. Chronic exposure to chromium(III) irritates the airways, malnourishes the liver and kidneys, causes fluid in the lungs, and adverse effects on white blood cells, and also increases the risk of developing lung cancer.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
chromium oxychloride	14977-61-8	>98
may decompose in the presence of water/moisture to		
hydrogen chloride	7647-01-0	
chlorine	7782-50-5	
chromium trioxide	1333-82-0	
chromic chloride	10025-73-7	

Section 4 - FIRST AID MEASURES

SWALLOWED
· For advice, contact a Poisons Information Center or a doctor at once. · Urgent hospital treatment is likely to be needed.

EYE
■ If this product comes in contact with the eyes: · Immediately hold eyelids apart and flush the eye continuously with running water. · Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.

SKIN
■ If skin or hair contact occurs: · Immediately flush body and clothes with large amounts of water, using safety shower if available. · Quickly remove all contaminated clothing, including footwear.

INHALED
· If fumes or combustion products are inhaled remove from contaminated area. · Lay patient down. Keep warm and rested. Inhalation of vapors or aerosols (mists, fumes) may cause lung edema. Corrosive substances may cause lung damage (e.g.

NOTES TO PHYSICIAN
■ Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung edema often do not manifest until a few hours have passed and they are aggravated by physical effort.
For acute or short term repeated exposures to strong acids:
· Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
· Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.
Excellent warning properties force rapid escape of personnel from chlorine vapour thus most inhalations are mild to moderate. If escape is not possible, exposure to high concentrations for a very short time can result in dyspnea, haemophysis and cyanosis with later complications being tracheobroncho-pneumonitis and pulmonary oedema. Oxygen, intermittent positive pressure breathing apparatus and aerosolysed bronchodilators are of therapeutic value where chlorine inhalation has been light to moderate. Severe inhalation should result in hospitalisation and treatment for a respiratory emergency.
Any chlorine inhalation in an individual with compromised pulmonary function (COPD) should be regarded as a severe inhalation and a respiratory emergency. [CCINFO, Dow 1988]
Effects from exposure to chlorine gas include pulmonary oedema which may be delayed. Observation in hospital for 48 hours is recommended
Diagnosed asthmatics and those people suffering from certain types of chronic bronchitis should receive medical approval before being employed in occupations involving chlorine exposure.
If burn is present, treat as any thermal burn, after decontamination.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not available
Upper Explosive Limit (%):	Not applicable
Specific Gravity (water=1):	1.911
Lower Explosive Limit (%):	Not applicable

EXTINGUISHING MEDIA
· DO NOT use water.

FIRE FIGHTING
· Alert Emergency Responders and tell them location and nature of hazard.
· May be violently or explosively reactive.
When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

· Will not burn but increases intensity of fire.
· Heating may cause expansion or decomposition leading to violent rupture of containers.
· Non combustible.
· Not considered to be a significant fire risk.
Decomposition may produce toxic fumes of: hydrogen chloride, metal oxides.

FIRE INCOMPATIBILITY

· Keep dry.
· NOTE: May develop pressure in containers; open carefully. Vent periodically.
Can produce intense heat and toxic fumes.

PERSONAL PROTECTION

Glasses:
Chemical goggles.
Full face- shield.
Gloves:
Respirator:
Type BE-P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
· Clean up all spills immediately.
· Avoid breathing vapors and contact with skin and eyes.
MAJOR SPILLS
■ Environmental hazard - contain spillage.
· Clear area of personnel and move upwind.
· Alert Emergency Responders and tell them location and nature of hazard.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

· DO NOT allow clothing wet with material to stay in contact with skin.
· Avoid personal contact and inhalation of dust, mist or vapors.
· Provide adequate ventilation.
· Avoid all personal contact, including inhalation.
· Wear protective clothing when risk of exposure occurs.

RECOMMENDED STORAGE METHODS

■ DO NOT use aluminum or galvanized containers.
Check regularly for spills and leaks.
Glass container.
· DO NOT use unlined steel containers.
· Lined metal can, Lined metal pail/drum
· Plastic pail.
For low viscosity materials
· Drums and jerricans must be of the non-removable head type.
· Where a can is to be used as an inner package, the can must have a screwed enclosure.

STORAGE REQUIREMENTS

· Store in original containers.
· Keep containers securely sealed.
Decomposes in light and in the presence of moisture.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US NIOSH Recommended Exposure Limits (RELs)	chromium oxychloride (Chromyl chloride)		0.001						See Appendix A; See Appendix C; Ca; (TWA (as Cr(VI)))
US ACGIH Threshold Limit Values (TLV)	chromium oxychloride (Chromyl chloride)	0.025							TLV Basis: upper respiratory tract & skin irritation

Canada - Alberta Occupational Exposure Limits	chromium oxychloride (Chromyl chloride)	0.025	0.2				
US - California Permissible Exposure Limits for Chemical Contaminants	chromium oxychloride (Chromyl chloride)	0.025	0.15				
Canada - British Columbia Occupational Exposure Limits	chromium oxychloride (Chromyl chloride)	0.025					
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	chromium oxychloride (Chromyl chloride)	0.025	0.16				
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	chromium oxychloride (Chromyl chloride)	0.025		0.07			
US - Washington Permissible exposure limits of air contaminants	chromium oxychloride (Chromyl chloride (as Cr) (see WAC 296-62-08003) (see WAC 296-62-08003))		0.005				
US - Hawaii Air Contaminant Limits	chromium oxychloride (Chromyl chloride)	0.025	0.15				
Canada - Prince Edward Island Occupational Exposure Limits	chromium oxychloride (Chromyl chloride)	0.025					TLV Basis: upper respiratory tract & skin irritation
Canada - Nova Scotia Occupational Exposure Limits	chromium oxychloride (Chromyl chloride)	0.025					TLV Basis: upper respiratory tract & skin irritation
Canada - Prince Edward Island Occupational Exposure Limits	chromium oxychloride (Hydrogen chloride)				2		TLV Basis: upper respiratory tract irritation
Canada - Nova Scotia Occupational Exposure Limits	chromium oxychloride (Hydrogen chloride)				2		TLV Basis: upper respiratory tract irritation
Canada - Northwest Territories Occupational Exposure Limits (English)	chromium oxychloride (Hydrogen chloride)				5	7.5	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	chromium oxychloride (Hydrogen chloride)				5	7	
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	chromium oxychloride (Hydrogen chloride)				5	7,5	

US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	chromium oxychloride (Hydrogen chloride)					5	7
US - Oregon Permissible Exposure Limits (Z-1)	chromium oxychloride (Hydrogen chloride)					5	7
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	chromium oxychloride (Hydrogen chloride)					2	
US - Washington Permissible exposure limits of air contaminants	chromium oxychloride (Hydrogen chloride)					5.0	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	chromium oxychloride (Hydrogen chloride)	5	7	-	-		
US - Michigan Exposure Limits for Air Contaminants	chromium oxychloride (Hydrogen chloride)					5	7
US - Alaska Limits for Air Contaminants	chromium oxychloride (Hydrogen chloride)					5	7
US - Hawaii Air Contaminant Limits	chromium oxychloride (Hydrogen chloride)					5	7
US - Idaho - Limits for Air Contaminants	chromium oxychloride (Hydrogen chloride)					5	7
US - California Permissible Exposure Limits for Chemical Contaminants	chromium oxychloride (Hydrogen chloride; muriatic acid)	5	7			C	
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	chromium oxychloride (Hydrogen chloride)					5	7
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	chromium oxychloride (Hydrogen chloride)	(C)5	(C)7				
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	chromium oxychloride (Hydrogen chloride)					5	7

US NIOSH Recommended Exposure Limits (RELs)	chromium oxychloride (Hydrogen chloride)					5	7	
US ACGIH Threshold Limit Values (TLV)	chromium oxychloride (Hydrogen chloride)					2		TLV Basis: upper respiratory tract irritation
US - Minnesota Permissible Exposure Limits (PELs)	chromium oxychloride (Hydrogen chloride)					5	7	
Canada - British Columbia Occupational Exposure Limits	chromium oxychloride (Hydrogen chloride Revised 2003)					2		
Canada - Alberta Occupational Exposure Limits	chromium oxychloride (Hydrogen chloride)					2	3	
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	chromium oxychloride (Chlorine)	0.5	1.5	1	3			
Canada - Prince Edward Island Occupational Exposure Limits	chromium oxychloride (Chlorine)	0.5		1				TLV Basis: upper respiratory tract & eye irritation
Canada - Nova Scotia Occupational Exposure Limits	chromium oxychloride (Chlorine)	0.5		1				TLV Basis: upper respiratory tract & eye irritation
Canada - Northwest Territories Occupational Exposure Limits (English)	chromium oxychloride (Chlorine)	1	3	3	8.7	3	8.7	
US OSHA Permissible Exposure Levels (PELs) - Table Z1	chromium oxychloride (Chlorine)					1	3	
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	chromium oxychloride (Chlorine)	0.5	1.5	1	2.9			
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	chromium oxychloride (Chlorine)					1	3	
US - Oregon Permissible Exposure Limits (Z-1)	chromium oxychloride (Chlorine)					1	3	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination	chromium oxychloride (Chlorine)	0.5		1				

Limits									
US - Washington Permissible exposure limits of air contaminants	chromium oxychloride (Chlorine)	0.5				1			
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	chromium oxychloride (Chlorine)	1	3	3	9				
US - Michigan Exposure Limits for Air Contaminants	chromium oxychloride (Chlorine)	0.5	1.5	1	3				
US - Alaska Limits for Air Contaminants	chromium oxychloride (Chlorine)	0.5	1.5	1	3				
US - Hawaii Air Contaminant Limits	chromium oxychloride (Chlorine)	0.5	1.5	1	3				
US ACGIH Threshold Limit Values (TLV)	chromium oxychloride (Chlorine)	0.5		1					TLV Basis: upper respiratory tract & eye irritation
US - California Permissible Exposure Limits for Chemical Contaminants	chromium oxychloride (Chlorine)	0.5	1.5	1	3				
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	chromium oxychloride (Chlorine)	(C)1	(C)3						
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	chromium oxychloride (Chlorine)	0.5	1.5	1	3				
US - Idaho - Limits for Air Contaminants	chromium oxychloride (Chlorine)					1	3		
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	chromium oxychloride (CHLORINE)	0.00005							
Canada - British Columbia Occupational Exposure Limits	chromium oxychloride (Chlorine)	0.5		1					
Canada - Alberta Occupational Exposure Limits	chromium oxychloride (Chlorine)	0.5	1.5	1	2.9				
US NIOSH Recommended Exposure Limits (RELs)	chromium oxychloride (Chlorine)					0.5	1.45		(Ceiling ([15-minute]))
US ATSDR Minimal Risk Levels for Hazardous	chromium oxychloride (CHLORINE)	0.002							

Substances (MRLs)					
US ATSDR Minimal Risk Levels for Hazardous Substances (MRLs)	chromium oxychloride (CHLORINE)	0.07			
US - Minnesota Permissible Exposure Limits (PELs)	chromium oxychloride (Chlorine)	0.5	1.5	1	3

ENDOELTABLE

PERSONAL PROTECTION

RESPIRATOR

• type be-p filter of sufficient capacity.
Consult your EHS staff for recommendations

EYE

· Chemical goggles.
· Full face shield.

HANDS/FEET

■ Elbow length PVC gloves.
· When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
· frequency and duration of contact,
· chemical resistance of glove material,
· glove thickness and
· dexterity
Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).
· When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
· When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
· Contaminated gloves should be replaced.
Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER

· Overalls.
· PVC Apron.

ENGINEERING CONTROLS

■ Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator.
CAUTION: Burns and blisters the skin: Handle ONLY in well-ventilated hood.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Liquid.
Corrosive.
Acid.

State	Liquid	Molecular Weight	154.90
Melting Range (°F)	-142	Viscosity	Not Available
Boiling Range (°F)	243	Solubility in water (g/L)	Reacts
Flash Point (°F)	Not Applicable	pH (1% solution)	Not available
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable

Autoignition Temp (°F)	Not applicable	Vapour Pressure (mmHG)	Not available
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	1.911
Lower Explosive Limit (%)	Not applicable	Relative Vapor Density (air=1)	>1
Volatile Component (%vol)	Not available	Evaporation Rate	Not available

APPEARANCE
Deep red liquid, appears black under reflected light. Reacts with water to produce acids and chlorine. Soluble in carbon tetrachloride, carbon disulfide, benzene, nitrobenzene, CHCl3, POCL3.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY
· Presence of incompatible materials.
· Contact with alkaline material liberates heat.

STORAGE INCOMPATIBILITY
· WARNING: Avoid or control reaction with peroxides. All transition metal peroxides should be considered as potentially explosive. For example transition metal complexes of alkyl hydroperoxides may decompose explosively.
· The pi-complexes formed between chromium(0), vanadium(0) and other transition metals (haloarene-metal complexes) and mono-or poly-fluorobenzene show extreme sensitivity to heat and are explosive.
· Avoid reaction with borohydrides or cyanoborohydrides.
· Inorganic acids are generally soluble in water with the release of hydrogen ions. The resulting solutions have pH's of less than 7.0.
· Inorganic acids neutralize chemical bases (for example: amines and inorganic hydroxides) to form salts.
Segregate from alcohol, water.
· Avoid strong bases.
· NOTE: May develop pressure in containers; open carefully. Vent periodically.
Hydrogen chloride:
· reacts strongly with strong oxidisers (releasing chlorine gas), acetic anhydride, caesium cyanotridecahydrodecaborate(2-), ethylidene difluoride, hexalithium disilicide, metal acetylide, sodium, silicon dioxide, tetraselenium tetranitride, and many organic materials
· is incompatible with aliphatic amines, alkanolamines, alkylene oxides, aluminium, aluminium-titanium alloys, aromatic amines, amides, 2-aminoethanol, ammonia, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, ethylenediamine, ethyleneimine, epichlorohydrin, isocyanates, metal acetylides, metal carbides, oleum, organic anhydrides, perchloric acid, 3-propiolactone, sulfuric acid, uranium phosphide, vinyl acetate, vinylidene fluoride
· attacks most metals forming flammable hydrogen gas, and some plastics, rubbers and coatings.
Reacts violently with liquid or gaseous ammonia.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

chromium oxychloride

TOXICITY AND IRRITATION
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
CHROMIUM TRIOXIDE:
CHROMIC CHLORIDE:
CHROMIUM OXYCHLORIDE:
■ Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's edema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type.
CHROMIC CHLORIDE:
CHROMIUM TRIOXIDE:
■ Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure.
■ Attention should be paid to atopic diathesis, characterized by increased susceptibility to nasal inflammation, asthma and eczema.
■ Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms.
■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.
CHROMIUM OXYCHLORIDE:
■ The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
The material may produce respiratory tract irritation, and result in damage to the lung including reduced lung function.
The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

HYDROGEN CHLORIDE:

TOXICITY	IRRITATION
Inhalation (human) LCLo: 1300 ppm/30m	Eye (rabbit): 5 mg/30s - Mild
Inhalation (human) LCLo: 3000 ppm/5m	
Inhalation (rat) LC50: 3124 ppm/60m	

■ The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
4701 ppm/30m

TOXICITY	IRRITATION

CHLORINE:

Inhalation (human) LCLo: 500 ppm/5 minutes	
Inhalation (rat) LC50: 293 ppm/1 hour	

CHROMIUM TRIOXIDE:

Oral (rat) LD50: 80 mg/kg	Skin (human): corrosive
Inhalation (human) TCLo: 0.11 mg/m³	

■ WARNING: This substance has been classified by the IARC as Group 1: CARCINOGENIC TO HUMANS.

CHROMIC CHLORIDE:

Oral (rat) LD50: 1790 mg/kg	Nil Reported
Oral (rat) LD50: 1870 mg/kg	
Inhalation (mouse) LC50: 31.5 mg/m³/2h	
Intraperitoneal (mouse) LD50: 434 mg/kg	
Intramuscular (mouse) LD50: 40 mg/kg	
Intravenous (Rabbit) LD: 288 mg/kg	
Intraperitoneal (Guinea pig) LD: 200 mg/kg	
Intraperitoneal (Mouse) LD50: 143 mg/kg	
Subcutaneous (Mouse) LD: 800 mg/kg	
Intravenous (Mouse) LD: 400 mg/kg	

■ For chrome(III) and other valence states (except hexavalent):

For inhalation exposure, all trivalent and other chromium compounds are treated as particulates, not gases.

The mechanisms of chromium toxicity are very complex, and although many studies on chromium are available, there is a great deal of uncertainty about how chromium exerts its toxic influence. Much more is known about the mechanisms of hexavalent chromium toxicity than trivalent chromium toxicity. There is an abundance of information available on the carcinogenic potential of chromium compounds and on the genotoxicity and mutagenicity of chromium compounds in experimental systems. The consensus from various reviews and agencies is that evidence of carcinogenicity of elemental, divalent, or trivalent chromium compounds is lacking. Epidemiological studies of workers in a number of industries (chromate production, chromate pigment production and use, and chrome plating) conclude that while occupational exposure to hexavalent chromium compounds is associated with an increased risk of respiratory system cancers (primarily bronchogenic and nasal), results from occupational exposure studies to mixtures that were mainly elemental and trivalent (ferrochromium alloy worker) were inconclusive. Studies in leather tanners, who were exposed to trivalent chromium were consistently negative. In addition to the lack of direct evidence of carcinogenicity of trivalent or elemental chromium and its compounds, the genotoxic evidence is overwhelmingly negative.

The lesser potency of trivalent chromium relative to hexavalent chromium is likely related to the higher redox potential of hexavalent chromium and its greater ability to enter cells. enter cells

The general inability of trivalent chromium to traverse membranes and thus be absorbed or reach peripheral tissue in significant amounts is generally accepted as a probable explanation for the overall absence of systemic trivalent chromium toxicity. Elemental and divalent forms of chromium are not able to traverse membranes readily either. This is not to say that elemental, divalent, or trivalent chromium compounds cannot traverse membranes and reach

peripheral tissue, the mechanism of absorption is simply less efficient in comparison to absorption of hexavalent chromium compounds. Hexavalent chromium compounds exist as tetrahedral chromate anions, resembling the forms of other natural anions like sulfate and phosphate which are permeable across nonselective membranes. Trivalent chromium forms octahedral complexes which cannot easily enter though these channels, instead being absorbed via passive diffusion and phagocytosis. Although trivalent chromium is less well absorbed than hexavalent chromium, workers exposed to trivalent compounds have had detectable levels of chromium in the urine at the end of a workday. Absorbed chromium is widely distributed throughout the body via the bloodstream, and can reach the foetus. Although there is ample in vivo evidence that hexavalent chromium is efficiently reduced to trivalent chromium in the gastrointestinal tract and can be reduced to the trivalent form by ascorbate and glutathione in the lungs, there is no evidence that trivalent chromium is converted to hexavalent chromium in biological systems. In general, trivalent chromium compounds are cleared rapidly from the blood and more slowly from the tissues. Although not fully characterized, the biologically active trivalent chromium molecule appears to be chromodulin, also referred to as (GTF). Chromodulin is an oligopeptide complex containing four chromic ions. Chromodulin may facilitate interactions of insulin with its receptor site, influencing protein, glucose, and lipid metabolism. Inorganic trivalent chromium compounds, which do not appear to have insulin-potentiating properties, are capable of being converted into biologically active forms by humans and animals

Chromium can be a potent sensitiser in a small minority of humans, both from dermal and inhalation exposures.

The most sensitive endpoint identified in animal studies of acute exposure to trivalent chromium appears to involve the respiratory system. Specifically, acute exposure to trivalent chromium is associated with impaired lung function and lung damage.

Based on what is known about absorption of chromium in the human body, its potential mechanism of action in cells, and occupational data indicating that valence states other than hexavalent exhibit a relative lack of toxicity the toxicity of elemental and divalent chromium compounds is expected to be similar to or less than common trivalent forms.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

The substance is classified by IARC as Group 3:

NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

for hexahydrate:

for anhydrous form:

Human cell mutagen

Paternal effect, effects on fertility, effects on embryo (extra embryonic

structures, foetotoxicity), specific developmental abnormalities (central

nervous system, eye, ear) recorded.

CARCINOGEN

Chromium (VI) compounds	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	1
chromium oxychloride	US - Rhode Island Hazardous Substance List	IARC	
chromium oxychloride	US - Rhode Island Hazardous Substance List	IARC	C
CHROMYL CHLORIDE	US Environmental Defense Scorecard Recognized Carcinogens	Reference(s)	P65-MC
CHROMYL CHLORIDE	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	P65-MC
CHROMIUM COMPOUNDS	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	HAZMAP, P65-MC
Chromium (hexavalent) (Oral)	US Air Toxics Hot Spots TSD for Describing Available Cancer Potency Factors	IARC Class	
Chromyl chloride	US NIOSH Recommended Exposure Limits (RELs) - Carcinogens	Carcinogen	Ca
VPVB_(VERY~	US - Maine Chemicals of High Concern List	Carcinogen	CA Prop 65

Hydrochloric acid	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Acid mists, strong inorganic	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	1
Hydrogen chloride	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4
hydrogen chloride	US - Rhode Island Hazardous Substance List	IARC	
TWAPPM~	US - Maine Chemicals of High Concern List	Carcinogen	A4
Chlorine	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4
chlorine	US - Rhode Island Hazardous Substance List	IARC	
Chromium (VI) inorganic compounds - Water soluble (as Cr)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A1
chromium trioxide	US - Rhode Island Hazardous Substance List	IARC	
chromium trioxide	US - Rhode Island Hazardous Substance List	IARC	C
CHROMIUM TRIOXIDE	US Environmental Defense Scorecard Recognized Carcinogens	Reference(s)	P65-MC
CHROMIUM TRIOXIDE	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	P65-MC
Polychlorinated biphenyls (PCBs) (high risk)(P)	US Air Toxics Hot Spots TSD for Describing Available Cancer Potency Factors	IARC Class	2A
Polychlorinated biphenyls (PCBs) (low risk)(P)	US Air Toxics Hot Spots TSD for Describing Available Cancer Potency Factors	IARC Class	
Chromium(VI) and its compounds - Water soluble (as Cr)	US NIOSH Recommended Exposure Limits (RELs) - Carcinogens	Carcinogen	Ca
TWAPPM~	US - Maine Chemicals of High Concern List	Carcinogen	A1
VPVB_(VERY~	US - Maine Chemicals of High Concern List	Carcinogen	EU Carcinogen
Chromium (III) compounds	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group	3
Chromium (III) inorganic compounds (as Cr)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4
chromic chloride	US - Rhode Island Hazardous Substance List	IARC	C

Section 12 - ECOLOGICAL INFORMATION

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
This material and its container must be disposed of as hazardous waste.
Avoid release to the environment.
Refer to special instructions/ safety data sheets.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
chromium oxychloride	No Data Available	No Data Available		

hydrogen chloride	LOW	No Data Available	LOW	HIGH
chlorine	No Data Available	No Data Available	LOW	
chromium trioxide	No Data Available	No Data Available	LOW	
chromic chloride	No Data Available	No Data Available		

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information
Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)
Toxicity characteristic: use EPA hazardous waste number D007 (waste code E) if this substance, in a solid waste, produces an extract containing greater than 5 mg/L of chromium.

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.
¦ Puncture containers to prevent re-use and bury at an authorized landfill.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:
· Reduction
· Reuse
· Recycling
· Disposal (if all else fails)
This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.
· Recycle wherever possible.
· Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.

Section 14 - TRANSPORTATION INFORMATION

DOT:
Symbols: None Hazard class or Division: 8
Identification Numbers: UN1758 PG: I
Label Codes: 8 Special provisions: A3, A6,
A7, B10,
N34, T10,
TP2
Packaging: Exceptions: None Packaging: Non- bulk: 201
Packaging: Exceptions: None Quantity limitations: 0.5 L
Passenger aircraft/rail:
Quantity Limitations: Cargo 2.5 L Vessel stowage: Location: C
aircraft only:
Vessel stowage: Other: 40, 66,
74, 89, 90
Hazardous materials descriptions and proper shipping names:
Chromium oxychloride

Air Transport IATA:

UN/ID Number: 1758 Packing Group: I
Special provisions: None
Cargo Only
Packing Instructions: 2.5 L Maximum Qty/Pack: 854
Passenger and Cargo Passenger and Cargo
Packing Instructions: 0.5 L Maximum Qty/Pack: 850
Passenger and Cargo Limited Quantity Passenger and Cargo Limited Quantity
Packing Instructions: Forbidden Maximum Qty/Pack: Forbidden
Shipping Name: CHROMIUM OXYCHLORIDE

Maritime Transport IMDG:

IMDG Class: 8 IMDG Subrisk: None
UN Number: 1758 Packing Group: I