The following information was generated from the
Hazardous Substances Databank (HSDB),
a database of the National Library of Medicine's TOXNET system
(http://toxnet.nlm.nih.gov) on March 16, 2004.

Query: The chemical name magnesium chloride was identified.
The following terms were added from ChemIDplus:
CAS Registry Number: 7791-18-6
The chemical name magnesium chloride was identified.
The following terms were added from ChemIDplus:
magnogene
magnesium dichloride
CAS Registry Number: 7786-30-3

1
NAME: MAGNESIUM CHLORIDE

RN: 7786-30-3

NO:
This record contains information specific to the title compound. Users
with an interest in this substance are strongly encouraged to retrieve the
Magnesium Compounds record, which has additional information on toxicity
and environmental fate of magnesium ions and compounds. For information on
the metal itself, refer to the MAGNESIUM, ELEMENTAL record.

HUMAN HEALTH EFFECTS:

HUMAN TOXICITY EXCERPTS:
/HUMAN EXPOSURE STUDIES/ HIGH BY IP & IV & MODERATE BY ORAL
ROUTES. HIGH= CAPABLE OF CAUSING DEATH OR PERMANENT INJURY DUE TO
EXPOSURES OF NORMAL USE; INCAPACITATING & POISONOUS...SPECIAL
HANDLING. MODERATE= ...REVERSIBLE OR IRREVERSIBLE CHANGES TO EXPOSED
TISSUE; NOT PERMANENT INJURY OR DEATH...CONSIDERABLE DISCOMFORT. [Lewis,
R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes
1-3. New York, NY: Van Nostrand Reinhold, 1996. 2078]**PEER REVIEWED**

/CASE REPORTS/ MAGNESIUM POISONING OF 6 PT OCCURRED DURING HEMODIALYSIS
BECAUSE OF MISTAKE IN PREPARING DIALYSATE SOLN WITH 15 INSTEAD OF 1.5 MEQ
OF MAGNESIUM CHLORIDE/L. ALL DEVELOPED FEELING OF HEAT, MOSTLY BURNING
SENSATION IN FACE, & MUSCULAR WEAKNESS. 3 COMPLAINED OF BLURRING OF

VISION BUT NONE HAD OBJECTIVE VISUAL DEFECT... [Grant, W. M. Toxicology of the Eye. 2nd ed. Springfield, Illinois: Charles C. Thomas, 1974. 639]**PEER REVIEWED**

EMERGENCY MEDICAL TREATMENT:

EMERGENCY MEDICAL TREATMENT:

<p>The following Overview, *** MAGNESIUM ***, is relevant for this
HSDB record chemical.
LIFE SUPPORT:

- This overview assumes that basic life support measures have been instituted.

CLINICAL EFFECTS:

0.2.1 SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

A) WITH THERAPEUTIC USE

1) Patients in renal failure and patients with metabolic derangements, such as those with anorexia nervosa and IV drug users, may develop magnesium toxicity at lower doses.

B) WITH POISONING/EXPOSURE

1) Hypermagnesemia may cause early flushing, nausea and vomiting followed by hypotension, ECG changes (prolonged PR and QRS intervals), CNS depression, respiratory depression and impairment of neuromuscular transmission (hyporeflexia, paralysis).
2) Elevated serum magnesium levels can occur in overdose patients with normal renal function following as few as 3 doses of 30 grams of magnesium sulfate every 4 hours as part of a multiple-dose activated charcoal/cathartic regimen. A single 30 gram magnesium sulfate dose did not produce elevated serum magnesium levels in this same setting.
3) Magnesium dust can irritate the eyes and mucous membranes of the upper respiratory tract causing atrophic nasopharyngitis.
4) METAL FUME FEVER can result from inhalation of magnesium fumes.

0.2.3 VITAL SIGNS

0.2.5 CARDIOVASCULAR

0.2.5.1 ACUTE EXPOSURE

A) WITH POISONING/EXPOSURE

1) Hypotension, bradycardia, first degree AV block, QRS prolongation, T wave inversion, and in severe cases, cardiac arrest may occur.

2) Excessive absorption of magnesium-containing cathartics may result in depressed cardiac function.

0.2.6 RESPIRATORY

0.2.6.1 ACUTE EXPOSURE

A) WITH POISONING/EXPOSURE

1) WITH POISONING/EXPOSURE

a) Respiratory depression is usually preceded by loss of deep tendon reflexes.

b) Respiratory arrest has been noted in infants following excessive absorption of magnesium from magnesium-containing cathartics.

0.2.7 NEUROLOGIC

0.2.7.1 ACUTE EXPOSURE

A) WITH POISONING/EXPOSURE

1) Lethargy, hyporeflexia, weakness, and subjective feeling of thirst and heat may occur.

2) Excessive absorption of magnesium from cathartics may result in CNS depression and seizures, most notably in renal failure patients.

0.2.8 GASTROINTESTINAL

0.2.8.1 ACUTE EXPOSURE

A) WITH THERAPEUTIC USE

1) Nausea and vomiting may occur.

0.2.14 DERMATOLOGIC

0.2.14.1 ACUTE EXPOSURE

A) WITH POISONING/EXPOSURE

1) Cutaneous flushing may be noted.

0.2.21 CARCINOGENICITY

0.2.21.1 IARC CATEGORY

A) IARC Carcinogenicity Ratings for CAS7439-95-4 (IARC, 2003):

1) Not Listed

0.2.21.2 HUMAN OVERVIEW

A) At the time of this review, no studies were found on the potential carcinogenic activity of magnesium in humans or experimental animals.

LABORATORY:

A) Monitor serum electrolytes, obtain baseline renal function, and monitor serial magnesium levels after significant exposure. Normal serum magnesium levels are 1.5 to 2.5 mEq/L.

B) Obtain an ECG and institute continuous cardiac monitoring in symptomatic patients.

TREATMENT OVERVIEW:

0.4.2 ORAL EXPOSURE

A) ACTIVATED CHARCOAL does not effectively adsorb magnesium salts.

B) MONITOR ECG and VITAL SIGNS frequently. Cardiovascular and/or respiratory assistance may be required.

C) CALCIUM - To temporarily ameliorate respiratory depression, administer IV calcium chloride 10% (DOSE:

0.2 to 0.5 mL/kg/dose up to 10 mL/dose over 5 to 10 minutes). Monitor ECG during infusion and stop if heart rate begins to decrease. Repeat dose if needed.

D) HYPOTENSION: Infuse 10 to 20 mL/kg isotonic fluid. If hypotension persists, administer dopamine (5 to 20 mcg/kg/min) or norepinephrine (ADULT: begin infusion at 0.5 to 1 mcg/min; CHILD: begin infusion at 0.1 mcg/kg/min); titrate to desired response.

E) HYPOTHERMIA - Place patient under a warming blanket or a "hugg-bear" or equivalent device.

F) HEMODIALYSIS - Is the most effective method to remove significant quantities of magnesium and may reverse life-threatening symptoms within 30 minutes.

RANGE OF TOXICITY:

A) Insufficient data in the literature to assess the acute toxic dose. In hypomagnesemia, 2 to 4 g/day may be tolerated orally. In eclampsia, doses of 1 to 2 g IV followed by 1 to 2 g/hr infusions are usually well tolerated.

B) Serum magnesium concentrations: normal range (1.5 to 2.5 mEq/L); nausea and vomiting may be seen at serum magnesium levels of 3 mEq/L; drowsiness, sweating, and unsteadiness at 4 mEq/L; QRS widening, P-R prolongation and loss of deep tendon reflexes at 5 mEq/L; bradycardia and hypotension at 6 to 7 mEq/liter; voluntary muscle paralysis, heart block, and respiratory paralysis at 10 to 15 mEq/liter.

TED AGENTS

ANIMAL TOXICITY STUDIES:

NON-HUMAN TOXICITY EXCERPTS:

/LABORATORY ANIMALS: Acute Exposure/ The effect of magnesium chloride on the ventricular fibrillation threshold (VFT) and the threshold for the ventricular premature contraction (VPCT) was studied in 20 dogs. Seven of the dogs were pre-treated with digitalis and four were in the form of heart-lung preparations. In the anesthetized, intact dogs, the VPCT was 0.19 +/- 0.01 mV. After treatment with magnesium chloride (100 mg/kg iv), the VPCT increased by 53% ($P < 0.01$). In the same group of animals, the VFT averaged 0.50 +/- 0.06 mV., which more than doubled after administration of magnesium. The threshold of VPCT in the digitalis-treated dogs measured 0.18 +/- 0.01 mV; this value doubled after magnesium. The VFT in the digitalized dogs also increased after magnesium; however, resistance to electrical defibrillation was encountered in this

group. In the heart-lung preparations, VPCT improved by 72% and a gain of 131% in the VFT followed magnesium administration. The results suggest that magnesium increases the ventricular threshold of arrhythmias in normal, denervated (heart-lung preparations) and also digitalis-treated hearts... . [Ghani MF, Rabah M; Am Heart J 94 (5): 600-2 (1977)]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ The minimum concn of K and Mg in cardioplegic solution to get cardiac arrest was studied. The isolated rat hearts were perfused by Langendorf perfusion with modified Krebs-Henseleit bicarbonate buffer solution, and their heart rates were measured. The perfusion of infusate of 15 mM/l of K-aspartate stopped the heart beat completely; it took 25 mM/l of magnesium chloride to get cardiac arrest. By their combination, however, heart was arrested with infusate of 10 mM/l of K-aspartate and 15 mM/l of magnesium chloride, which were lower concn than K-aspartate or magnesium chloride alone. [Takahashi J et al; Nippon Geka Gakkai Zasshi 85 (6): 534-40 (1984)]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ .../IT WAS/ FOUND THAT SLURRY OF MGCL2 CRYSTALS APPLIED TO RABBIT EYES CAUSED SPOTTY CLOUDING OF CORNEA & ANTERIOR LENS CORTEX WHICH SOON CLEARED. [Grant, W. M. Toxicology of the Eye. 2nd ed. Springfield, Illinois: Charles C. Thomas, 1974. 639]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ ...MAGNESIUM CHLORIDE.../IS/ ESSENTIALLY INNOCUOUS WHEN APPLIED IN SOLN TO EYES. ...CONCN OF 1% FOR 10 MIN, OR 10% FOR 1/2 MIN.../CAUSED/ NO DAMAGE TO EYE OR ALTERATION OF PUPIL, WHEN APPLIED TO RABBIT EYES AFTER MECHANICAL REMOVAL OF CORNEAL EPITHELIUM TO FACILITATE PENETRATION. [Grant, W. M. Toxicology of the Eye. 2nd ed. Springfield, Illinois: Charles C. Thomas, 1974. 639]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ In order to

examine the toxicity of magnesium chloride hexahydrate, four groups of 10 male and 10 female F344 rats received the compound by dietary supplementation at 2.5, 0.5, 0.1 or 0% for 90 days. No treatment-related death was observed during the study. Transient soft stool and sustained increase in water consumption were observed both in males and females of the 2.5% group and slight reduction in body weight gain was noted in the high-dose males. There were no toxic changes in food consumption, organ weights, hematology and biochemistry, and histopathological examinations in any treated-groups. Based on these results, the no-observed-adverse-effect-level was estimated to be 0.5%, and 2.5% is considered to be appropriate as highest dose for a 2-year carcinogenicity study. /Magnesium chloride hexahydrate/ [Takizawa T et al; Kokuritsu Iyakuhin Shokuhin Eisei Kenkyusho Hokoku (118): 63-70 (2000)]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Magnesium chloride (MgCl2.6H2O) was administered at dietary levels of 0 (control), 0.3, 0.6, 1.25, 2.5 or 5% to groups of 10 male and 10 female B6C3F1 mice for 13 weeks. In both sexes of the 5% treatment group a decrease in body weight was observed. While clinical signs and hematological or blood biochemistry parameters showed no treatment-related effects, histopathologically, vacuolation of kidney tubular cells was apparent in males of the 2.5 and 5% concentration groups. Thus, the study demonstrated that diet containing over 2.5% MgCl2.6H2O exerts toxic effects in B6C3F1 mice. ... /Magnesium chloride hexahydrate/ [Tanaka H et al; Toxicol Lett 73 (1): 25-32 (1994)]**PEER REVIEWED**

/LABORATORY ANIMALS: Chronic Exposure or Carcinogenicity/ SYSTEMIC ADMIN OF 25 MG OF MAGNESIUM CHLORIDE/KG BODY WT IV TO RABBITS DAILY FOR 7-10 MO IS REPORTED TO HAVE INDUCED XEROPHTHALMIA DEMONSTRABLE HISTOLOGICALLY. [Grant, W. M. Toxicology of the Eye. 2nd ed. Springfield, Illinois: Charles C. Thomas, 1974. 639]**PEER REVIEWED**

/LABORATORY ANIMALS: Chronic Exposure or Carcinogenicity/ Groups of 50

male and 50 female B6C3F1 mice were given magnesium chloride (MgCl2.6H2O) at dose levels of 0 (control), 0.5 and 2% in the diet for 96 wk, after which all animals received the control diet for 8 wk and were then necropsied. In females of the high-dose group a decrease in body weight was observed. However, survival rates did not differ between the treatment and control groups for males or females. Furthermore, clinical signs and urinary, hematological or serum clinical chemistry parameters showed no treatment-related effects. On histological examination, tumors were mainly found in the skin/subcutis, liver and lymphatic system. However, with the exception of a significant decrease in the incidence of liver tumors among males of the high-dose group, no differences were noted in the tumor incidence between the treated and control animals. Thus, the study described here clearly shows a lack of carcinogenicity of MgCl2.6H2O given to B6C3F1 mice in the diet. /Magnesium chloride hexahydrate/ [Kurata Y et al; Food Chem Toxicol 27 (9): 559-63 (1989)]**PEER REVIEWED**

/LABORATORY ANIMALS: Neurotoxicity/ ...An in-vitro model using bronchial rings from New Zealand White rabbits /was/ stimulated to contract by electrical stimulation, histamine, or bethanechol. ...Magnesium chloride 1, 6, 16, 36, and 86 mM decreased the mean +/- SEM resting tension of bronchial rings by 40 +/- 16, 100 +/- 11, 110 +/- 10, 170 +/- 9, and 275 +/- 22 mg, respectively. Electrical stimulation (4) of 100 V/100 ms increased the mean +/- SEM resting tension by 168 +/- 52 mg. Magnesium chloride 5, 15, and 50 mM added to the tissue bath decreased the response to 100 V/100 ms to 65 +/- 27, 40 +/- 23, and 1 +/- 0 mg, respectively. Histamine 10 mM (4) increased mean +/- SEM resting tension by 490 +/- 121 mg. Magnesium chloride 5, 15, and 50 mM decreased the histamine response by 80 +/- 56, 250 +/- 74, and 475 +/- 131 mg, respectively. Bethanechol 6.25 mM (14) increased the mean +/- SEM resting tension by 495 +/- 74 mg.

Magnesium chloride (5, 15, 50 mM) decreased bethanechol-induced tension by 52 +/- 18, 184 +/- 26, and 506 +/- 64 mg, respectively. ...Magnesium chloride produced dose-dependent relaxation of bronchial smooth muscle at rest and when stimulated by histamine, bethanechol, or electrical impulse. Calcium chloride was unable to significantly reverse magnesium-induced relaxation. These data support the hypothesis that magnesium relaxes smooth muscle and dilates bronchial rings. [Spivey WH, et al; Ann Emerg Med 19 (10): 1107-1112 (1990)]**PEER REVIEWED**

/LABORATORY ANIMALS: Neurotoxicity/ In order to relate the cardiac antiarrhythmic properties of magnesium chloride (MgCl2) to its electrophysiological effects, a comparison of its actions on three different models of automaticity of the isolated Purkinje fibers of the dog, has been carried out. The spontaneous activity of the Purkinje fibers perfused with Tyrode's solution containing 2.7 mM KC1 was gradually reduced as MgC12 concentration was increased from 3-9 mM/1. The automaticity induced adding barium chloride (BaC12) to the perfusion solution was suppressed increasing the concentration of MgC12 in the Tyrode's solution up to 5 mM/1. Previous increases in the concentration of MgC12 prevents the electrophysiological effects BaC12. The negative chronotropic effects of MgC12, were less evident on the adrenalin induced automaticity of the Purkinje fibers. Simultaneous addition of adrenalin and MgC12 to the perfusion media increases membrane resting potential action potential amplitude and maximun rate of depolarisation of phase O in Purkinje fibers. It is concluded that MgC12 acts by distinct electrophysiological mechanisms against the different models of cardiac automaticity studied. [Berdeja Garcia GY, Pastelin G; Arch Inst Cardiol Mex 52 (6): 453-460]**PEER REVIEWED**

/ALTERNATIVE IN VITRO TESTS/ Effects of ...magnesium on the responsiveness of BALB/c mouse spleen lymphocytes to a mitogen, concanavalin A (Con A), were studied using the in vitro 3H-thymidine (TdR) incorporation test. ...Magnesium stimulated TdR incorporation up to a

maximum of 200% of the control level at concentrations greater than 2.0 mumol MgCl2/ml. Also, gradual increase of magnesium concentration in the culture medium up to 2.0 mumol/ml attenuated the effects of nickel, restoring the lymphocyte response to Con A to 43% of the control level at 0.25 mumol NiCl2/ml or to 30% at 0.33 mumol Ni3S2/ml. Higher concentrations of magnesium did not further enhance this responsiveness. [Kasprzak KS, et al; Magnesium 7 (3): 166-172 (1988)]**PEER REVIEWED**

NON-HUMAN TOXICITY VALUES:
LD50 Rat oral 2800 mg/kg [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 2078]**PEER REVIEWED**

LD50 Mouse intraperitoneal 1338 mg/kg [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 2078]**PEER REVIEWED**

LD50 Mouse intravenous 14 mg/kg [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 2078]**PEER REVIEWED**

METABOLISM/PHARMACOKINETICS:

ABSORPTION, DISTRIBUTION & EXCRETION:
...Three mature ewes each received by intrarumenal infusion a supplement of 0, 1, 2 and 3 g Mg/d in sequence over four 10-day periods. Net Mg absorption distal to the pylorus took place down its electrochemical gradient, although the quantity absorbed remained small during the control and first infusion periods. The bulk of Mg absorption occurred before the pylorus and, during the control and first infusion periods, took place against its electrochemical gradient. The net Mg absorption proximal to the pylorus rose with declining efficiency as Mg intake was increased. It is suggested that saturation of the absorption process at this site was

occurring. [McLean AF, et al; Br J Nutr 52 (3): 523-527 (1984)]**PEER REVIEWED**

MECHANISM OF ACTION:
MECHANISMS OF ACTION OF MAGNESIUM CHLORIDE STUDIED IN 10 ADULT VOLUNTEERS.
RESULTS SUGGESTED MAGNESIUM ION IN DUODENUM IS RELATIVELY WEAK STIMULUS TO
PANCREAS & GALLBLADDER. IT IS WEAK STIMULANT TO CHOLECYSTOKININ
RELEASE & INHIBITS NET JEJUNAL WATER ABSORPTION. [MALAGELADA J ET AL;
AM J DIG DIS (23) 481 (1978)]**PEER REVIEWED**

...The oral administration of a single /800 mg/ dose of magnesium chloride
/in healthy volunteers/ resulted in a diminished rate of intraluminal
lipid and protein digestion. The most pronounced effect of magnesium
chloride, however, was a decreased gastric emptying rate of both test
meals. After correction for gastric emptying, no differences were noted in
intraluminal lipid or protein digestion. Therefore, the lower lipid levels
noted after magnesium supplementation are unlikely to be the result of
altered lipid assimilation. Magnesium chloride slows gastric emptying but
does not influence lipid digestion. [Geboes KP et al ;Aliment Pharmacol
Ther 16 (8): 1571-1577 (2002)]**PEER REVIEWED**

INTERACTIONS:
Magnesium chloride (ip) administered simultaneously with Neguvon (ip)
decreased the lethal effects of Neguvon, however, this was not observed
with magnesium aspartate. [Kaemmerer K, Kietzmann M; Zentralbl
Veterinaermed, Reihe A 31 (4): 251-68 (1984)]**PEER REVIEWED**

The effects of intracerebroventricular administration of calcium or
magnesium on the blood pressure regulation in the brain were investigated.
The systolic blood pressure in spontaneously hypertensive rats (male,
13-wk-old) was decreased by calcium chloride (100 ug/rat) and increased by
magnesium chloride (20, 100, or 500 ug/rat). The depressor response
induced by calcium was inhibited by magnesium chloride in a dose-dependent
manner. Combining these results with those previously reported, it is

suggested that magnesium inhibits the ability of calcium to reduce blood pressure through calmodulin- and dopamine-dependent functions in the brain. [Sutoo D, Akiyama K; Jpn J Pharmacol 86 (3): 366-368 (2001)]**PEER REVIEWED**

Three adult male squirrel monkeys that were trained to respond on a 3-min fixed-interval schedule of food reinforcement were injected with various doses of magnesium chloride (MgCl(2), 30 and 100 mg/kg), cocaine (0.03-3.0 mg/kg), and their combination. ...MgCl(2) had little effect on responding during the 2 hr sessions. Low doses of cocaine (0.03-0.1 mg/kg) were ineffective, intermediate doses (0.1-1.0 mg/kg) increased responding, and high doses (1.0-3.0 mg/kg) decreased responding. When MgCl(2) was combined with intermediate doses of cocaine, the rate-increasing effects of cocaine were attenuated. Less reliably, increased rates of responding were sometimes observed when MgCl(2) was combined with low (ineffective) or high (rate-decreasing) doses of cocaine. These interactions depended both on the time following injection and the dose of MgCl(2) and showed marked individual differences. These effects observed in monkeys are similar to some of the interactions previously reported in rodents. [Kantak KM; Behav Pharmacol 2 (2): 97-104 (1991)]**PEER REVIEWED**

...In Ca-free soln, maintained contractions /in estrogen-dominated rat uterus/ induced by oxytocin and vanadate are augmented by Mg2+ /(administered as MgCl2)/. [D'Ocon MP et al; J Pharm Pharmacol 39 (6): 444-448]**PEER REVIEWED**

...Basic fibroblast growth factor (bFGF) has been shown to be neuroprotective against excitotoxic, ischemic, and traumatic injury to the CNS, while acute posttraumatic treatment with magnesium (Mg2+) has been shown to decrease the motor and cognitive deficits following experimental brain injury. In this study, bFGF and Mg2+ were evaluated separately and in combination to assess their potential additive effects on posttraumatic

neurological recovery and histological cell loss (lesion volume) /in rats/. ...Injured animals had a significant motor deficit when compared to sham (uninjured) animals at both 48 hr and 7 days postinjury. At 48 hr postinjury, there were no significant differences among injured animals when compared by treatment. By 7 days postinjury, injured animals treated with MgCl2 alone displayed significantly improved motor function when compared to brain-injured, vehicle-treated animals ($p < 0.05$). Animals treated with either bFGF alone or a combination of MgCl2 and bFGF displayed no significant neurological improvement relative to vehicle-treated injured animals at 7 days. No effect of any drug treatment of combination was observed on the extent of the postinjury lesion volume in the injured cortex. These results suggest that caution must be exercised when combining "cocktails" of potentially neuroprotective compounds in the setting of traumatic brain injury. [Guluma KZ, et al; J Neurotrauma 16 (4): 311-321 (1999)]**PEER REVIEWED**

...The inhibitory effect of NiCl2 on DNA replication was prevented by the addition of magnesium chloride (MgCl2) to cells maintained in a simple salts/glucose medium (SGM). This effect did not appear to be due to an antagonism of the cellular uptake of nickel by Mg2+, since the maximally effective dose of Mg2+ reduced 63Ni2+ uptake by no more than 25% while the inhibition of replication was completely reversed. [Conway K, et al; J Biochem Toxicol 1 (2): 11-25 (1986)]**PEER REVIEWED**

Effects of nickel and magnesium on the responsiveness of BALB/c mouse spleen lymphocytes to a mitogen, concanavalin A (Con A), were studied using the in vitro 3H-thymidine (TdR) incorporation test. Nickel chloride (NiCl2) and nickel subsulfide (Ni3S2) were found to suppress this response. ...Magnesium stimulated TdR incorporation up to a max of 200% of the control level at concentrations > 2.0 mumol MgCl2/ml. Also, gradual increase of magnesium concentration in the culture medium... attenuated the effects of nickel, restoring the lymphocyte response to

Con A... . [Kasprzak KS, et al; Magnesium 7 (3): 166-172 (1988)]**PEER REVIEWED**

PHARMACOLOGY:

THERAPEUTIC USES:
MAGNESIUM CHLORIDE USP, ANHYDROUS /USED AS/ ELECTROLYTE REPLENISHER;
PHARMACEUTIC NECESSITY FOR HEMODIALYSIS & PERITONEAL DIALYSIS FLUIDS.
[Osol, A. and J.E. Hoover, et al. (eds.). Remington's Pharmaceutical
Sciences. 15th ed. Easton, Pennsylvania: Mack Publishing Co., 1975.
1263]**PEER REVIEWED**

Parenteral magnesium chloride and magnesium sulfate are used in conditions
that require an increase in magnesium ions for electrolyte adjustment.
/Included in US product labeling/ [MICROMEDEX Thomson Health Care. USPDI -
Drug Information for the Health Care Professional. 22nd ed. Volume 1.
MICROMEDEX Thomson Health Care, Greenwood Village, CO. 2002. Content
Reviewed and Approved by the U.S. Pharmacopeial Convention,
Inc.1942]**PEER REVIEWED**

TWO CASES OF RICKETS ASSOC WITH HYPOMAGNESEMIA ARE REPORTED; THEY DID NOT
RESPOND TO TREATMENT WITH MASSIVE DOSES OF VITAMIN D, BUT SHOWED EXCELLENT
RESPONSE TO ORAL MAGNESIUM CHLORIDE SUPPLEMENTATION (20 MEQ/DAY). [REDDY
V, SIVAKUMAR B; LANCET 1: 963 (1974)]**PEER REVIEWED**

MEDICATION (VET): MGCL2 ENEMAS ARE SUGGESTED AS EMERGENCY TREATMENT FOR
BEEF COWS SHOWING SIGNS OF HYPOMAGNESEMIC TETANY. [BELL MC ET AL; TENN
FARM HOME SCI, PROG REP 104: 22 (1977)]**PEER REVIEWED**

Magnesium has been shown to be involved with the processes associated with
brain injury and its use in animal models of brain injury has received
considerable attention. The present paper reviews the use of MgCl2 therapy
to facilitate behavioral recovery and to reduce subcortical degeneration
in an electrolytic lesion model of cortical injury in the rat. ...The

results from these studies indicate that MgCl2 therapy is effective in facilitating recovery of function and limiting subcortical degeneration, is as effective as other neuroprotective agents, and can induce recovery of function in a chronic lesion model. ... [Hoane MR, Barth TM; Magnes Res 14 (1-2): 51-63 (2001)]**PEER REVIEWED**

...Traumatic brain injury /to male Sprague-Dawley rats/ resulted in a lesion in the ipsilateral cortex and loss of pyramidal neurons in the CA3 region of the hippocampus in vehicle-treated animals ($p < 0.01$ vs. uninjured animals). Administration of MgCl2 significantly reduced the injury-induced damage in the cortex ($p < 0.01$) but did not alter posttraumatic cell loss in the CA3 region of the ipsilateral hippocampus.
The present study demonstrates that, in addition to its beneficial effects on behavioral outcome, MgCl2 treatment attenuates cortical histological damage when administered following traumatic brain injury. [Bareyre FM, et al; J Neurotrauma 17 (11): 1029-1039 (2000)]**PEER REVIEWED**

Experimental evidence suggests that magnesium plays a role in the pathophysiological sequelae of brain injury. The present study examined the variation of blood ionized and total magnesium, as well as potassium, sodium, and ionized calcium, after experimental fluid percussion brain injury in rats. Blood ionized magnesium concentration significantly declined from 0.45 +/- 0.02 to 0.32 +/- 0.02 mM by 30 min postinjury and stayed depressed for the 24-hr study period in vehicle-treated rats.
Blood total magnesium concentration was 0.59 +/- 0.01 mM and remained stable over time in brain-injured vehicle-treated animals. When magnesium chloride (125 umol/rat) was administered 1 hr postinjury, ionized magnesium levels were restored by 2 hr postinjury and remained at normal values up to 24 hr following brain trauma. Magnesium treatment also significantly reduced posttraumatic neuromotor impairments 1 and 2 weeks after the insult, but failed to attenuate spatial learning deficits. ...
[Bareyre FM, et al; J Neurochem 73 (1): 271-280 (1999)]**PEER REVIEWED**

...Ten patients with angiographically documented /coronary artery disease
received an IV injection of 5 ml of a soln containing 17% magnesium
chloride/. After magnesium chloride injection, the /left ventricular
end-diastolic pressure/ was significantly reduced in all patients, from a
mean of 24 +/- 3 to 16 +/- 3 mmHg (P < 0.001). Under the short term
conditions of the study, the injection of magnesium chloride effectively
improved left ventricular diastolic function. [Kraus F; Can J Cardiol 9
(7): 618-620 (1993)]**PEER REVIEWED**

The effect of magnesium, given orally as enteric-coated magnesium chloride
tablets, on the ECG of 25 randomly selected patients was investigated.
Each patient, who served as his own control, was given 4-6 tablets, each
containing 0.5 g MgCl26H2O, at night for periods varying from 6 weeks to
2 years. Findings included (i) a statistically significant decrease in OTc
and QUc intervals; (ii) a progressive shortening of QTc and QUc intervals
with continuing therapy; (iii) reversion to normal of ECG abnormalities,
especially of ST segments and T waves. [Davis WH, Ziady F; S Afr Med J 53
(15): 591-593 (1978)]**PEER REVIEWED**

Magnesium deficiency frequently develops in patients with congestive heart
failure and may increase susceptibility to lethal arrhythmias and sudden
death via multiple pathophysiologic mechanisms. The effects of peroral
magnesium supplementation were investigated in a randomized, double-blind,
crossover trial involving 21 patients with stable congestive heart failure
secondary to coronary artery disease. All were receiving long-term loop
diuretics, and had normal renal function, and low or normal serum
magnesium concentrations. Subjects alternately received enteric-coated
magnesium chloride (15.8 mmol magnesium/day) and placebo for 6 weeks.
Magnesium therapy increased serum magnesium from 0.87 +/- 0.07 to 0.92 +/-
0.05 mmol/L (p < 0.05), serum potassium from 4.0 +/- 0.3 to 4.3 +/- 0.4

mmol/L (p < 0.01) and urinary magnesium excretion from 2.82 +/- 0.96 to 4.74 +/- 2.38 mmol/24 hr (p=0.001). There was no significant change in heart rate or Doppler cardiac index, but mean arterial pressure decreased from 91 +/- 10 to 87 +/- 10 mm Hg (p < 0.05) and systemic vascular resistance from 1,698 +/- 367 to 1,613 +/- 331 dynes s cm-5 (p=0.047). The frequency of isolated ventricular premature complexes was reduced by 23% (95% confidence interval 6-37%; p < 0.02), couplets by 52% (95% CI 30-65%; p < 0.001) and nonsustained ventricular tachycardia episodes by 24% (95% CI 15-49%; p < 0.01). Plasma epinephrine decreased from 447 +/- 535 to 184 +/- 106 pg/ml (p=0.02), but there was no corresponding change in plasma norepinephrine or heart rate variability. [Bashir Y, et al; Am J Cardiol 72 (15): 1156-1162 (1993)]**PEER REVIEWED**

/EXPTL THER/ Magnesium chloride (MgCl2) has been proposed for the treatment of seizures of different etiologies. The present study investigated the effect of MgCl2 on aldrin-induced seizures. Initially, 50 male rats received 60 mg aldrin/kg po and the effects were classified as muscular twitches, clonic convulsions or tonic-clonic convulsions. Another group of 40 rats dosed with 60 mg aldrin/kg po received 0, 4, 8, or 12 mg MgCl2/kg i.m. The percentage of tonic-clonic convulsant rats that resulted from MgCl2 treatment were 90% at 0 mg/kg, 50% at 4 mg/kg, 40% at 8 mg/kg and 20% at 12 mg MgCl2/kg. The percentage of survivors in the group receiving 12 mg MgCl2/kg was 80% while the control group had 20% survival. The clonic convulsions were not modified by MgCl2 treatment. ... [Lazarini CA, Vassilieff I; Vet Hum Toxicol 40 (5): 257-259 (1998)]**PEER REVIEWED**

...Over a 6-month period, 47 patients who were in preterm labor were randomized after parenteral magnesium tocolysis to receive magnesium gluconate ([Mg-g] 648 mg elemental magnesium/day) or magnesium chloride ([Mg-c] 640 mg elemental magnesium/day). ...These two preparations of magnesium are similar in their effects on uterine activity and serum

levels when used at these dosages. [Martin RW, et al; J Miss State Med Assoc 39 (5): 180-182 (1998)]**PEER REVIEWED**

/EXPTL THER/ Cardioprotective role of intravenous administration of magnesium chloride was evaluated in rabbits by biochemical and histopathological parameters. Myocardial damage was induced by injecting (iv) isoprenaline 1, 2.5, 5 and 7.5 mg/kg body weight of animal. ...Verapamil (5 uM) injected prior to 2.5 mg isoprenaline administration revealed significant reduction of CK /(the cardiac enzyme creatinine kinase)/ (C Max) activity ($P < 0.05$) compared to animals infused with isoprenaline alone. T-max value did not show any alteration in both the groups. Histopathological findings showed no areas of necrosis and cellular infiltrates in animals primed with 2.5 mg isoprenaline following verapamil. Highly significant reduction in CK (C-max) activity was observed in animals administered with 40 mg magnesium chloride prior to isoprenaline compared to animals treated with isoprenaline alone ($P < 0.001$). In addition to this, significant delay in T-max of CK activity was observed in group treated with 40 mg magnesium chloride and isoprenaline compared to group treated with only isoprenaline ($P < 0.01$). The study clearly highlighted and confirmed the valuable role of magnesium chloride as a cardioprotective agent. [Naik P, et al; Indian J Exp Biol 37 (2): 131-137 (1999)]**PEER REVIEWED**

INTERACTIONS:
Magnesium chloride (ip) administered simultaneously with Neguvon (ip) decreased the lethal effects of Neguvon, however, this was not observed with magnesium aspartate. [Kaemmerer K, Kietzmann M; Zentralbl Veterinaermed, Reihe A 31 (4): 251-68 (1984)]**PEER REVIEWED**

The effects of intracerebroventricular administration of calcium or magnesium on the blood pressure regulation in the brain were investigated. The systolic blood pressure in spontaneously hypertensive rats (male, 13-wk-old) was decreased by calcium chloride (100 ug/rat) and increased by magnesium chloride (20, 100, or 500 ug/rat). The depressor response

induced by calcium was inhibited by magnesium chloride in a dose-dependent manner. Combining these results with those previously reported, it is suggested that magnesium inhibits the ability of calcium to reduce blood pressure through calmodulin- and dopamine-dependent functions in the brain. [Sutoo D, Akiyama K; Jpn J Pharmacol 86 (3): 366-368 (2001)]**PEER REVIEWED**

Three adult male squirrel monkeys that were trained to respond on a 3-min fixed-interval schedule of food reinforcement were injected with various doses of magnesium chloride (MgCl(2), 30 and 100 mg/kg), cocaine (0.03-3.0 mg/kg), and their combination. ...MgCl(2) had little effect on responding during the 2 hr sessions. Low doses of cocaine (0.03-0.1 mg/kg) were ineffective, intermediate doses (0.1-1.0 mg/kg) increased responding, and high doses (1.0-3.0 mg/kg) decreased responding. When MgCl(2) was combined with intermediate doses of cocaine, the rate-increasing effects of cocaine were attenuated. Less reliably, increased rates of responding were sometimes observed when MgCl(2) was combined with low (ineffective) or high (rate-decreasing) doses of cocaine. These interactions depended both on the time following injection and the dose of MgCl(2) and showed marked individual differences. These effects observed in monkeys are similar to some of the interactions previously reported in rodents. [Kantak KM; Behav Pharmacol 2 (2): 97-104 (1991)]**PEER REVIEWED**

...In Ca-free soln, maintained contractions /in estrogen-dominated rat uterus/ induced by oxytocin and vanadate are augmented by Mg2+ /(administered as MgCl2)/. [D'Ocon MP et al; J Pharm Pharmacol 39 (6): 444-448]**PEER REVIEWED**

...Basic fibroblast growth factor (bFGF) has been shown to be neuroprotective against excitotoxic, ischemic, and traumatic injury to the CNS, while acute posttraumatic treatment with magnesium (Mg2+) has been shown to decrease the motor and cognitive deficits following experimental

brain injury. In this study, bFGF and Mg2+ were evaluated separately and in combination to assess their potential additive effects on posttraumatic neurological recovery and histological cell loss (lesion volume) /in rats/. ...Injured animals had a significant motor deficit when compared to sham (uninjured) animals at both 48 hr and 7 days postinjury. At 48 hr postinjury, there were no significant differences among injured animals when compared by treatment. By 7 days postinjury, injured animals treated with MgCl2 alone displayed significantly improved motor function when compared to brain-injured, vehicle-treated animals ($p < 0.05$). Animals treated with either bFGF alone or a combination of MgCl2 and bFGF displayed no significant neurological improvement relative to vehicle-treated injured animals at 7 days. No effect of any drug treatment of combination was observed on the extent of the postinjury lesion volume in the injured cortex. These results suggest that caution must be exercised when combining "cocktails" of potentially neuroprotective compounds in the setting of traumatic brain injury. [Guluma KZ, et al; J Neurotrauma 16 (4): 311-321 (1999)]**PEER REVIEWED**

...The inhibitory effect of NiCl2 on DNA replication was prevented by the addition of magnesium chloride (MgCl2) to cells maintained in a simple salts/glucose medium (SGM). This effect did not appear to be due to an antagonism of the cellular uptake of nickel by Mg2+, since the maximally effective dose of Mg2+ reduced 63Ni2+ uptake by no more than 25% while the inhibition of replication was completely reversed. [Conway K, et al; J Biochem Toxicol 1 (2): 11-25 (1986)]**PEER REVIEWED**

Effects of nickel and magnesium on the responsiveness of BALB/c mouse spleen lymphocytes to a mitogen, concanavalin A (Con A), were studied using the in vitro 3H-thymidine (TdR) incorporation test. Nickel chloride (NiCl2) and nickel subsulfide (Ni3S2) were found to suppress this response. ...Magnesium stimulated TdR incorporation up to a max of 200% of the control level at concentrations > 2.0 mumol MgCl2/ml. Also,

gradual increase of magnesium concentration in the culture medium...
attenuated the effects of nickel, restoring the lymphocyte response to
Con A... . [Kasprzak KS, et al; Magnesium 7 (3): 166-172 (1988)]**PEER
REVIEWED**

ENVIRONMENTAL FATE & EXPOSURE:

NATURAL POLLUTION SOURCES:
Magnesium is approx 2% of the earth's crust, eighth in elemental
abundance, and widely distributed in the environment as a variety of
compounds(1,2). Its concn is 1.8% and 1.6% in igneous and sedimentary
rocks, respectively(2). In igneous rocks, magnesium is typically a
constituent of the dark-colored ferromagnesium minerals (e.g., olivine,
pyroxenes, amphiboles, and dark-colored micas), along with other less
common minerals(2). In metamorphic rocks, magnesium minerals such as
chlorite, montmorillonite, and serpentine occur(2). Sedimentary rocks of
magnesium include carbonates (e.g., magnesite and hydromagnesite),
hydroxides (e.g., brucite), and mixtures of magnesium and calcium
carbonate (e.g., dolimite)(2). Magnesium is also found in silicate
minerals (e.g., olivine, serpentine, and asbestos)(1). Rocks and minerals
contain a higher percentage of magnesium than do soils as a result of the
loss of magnesium due to weathering(1). Magnesium chloride, with makes up
17% of sea salt(1) is released to the atmosphere as sea spray(SRC). [(1)
Aikawa JK; pp. 1025-1034 in Metals and Their Compounds in the Environment.
Merian E, ed. Weinheim, Germany: VCH (1991) (2) Bodek I et al, eds;
Environmental Inorganic Chemistry. Elmsford, NY: Pergamon Press pp. 6.5-1
to 6.5-10 (1988)]**PEER REVIEWED**

ARTIFICIAL POLLUTION SOURCES:
The production and use of magnesium compounds as refractories, as chemical
intermediates, and in construction materials(1,2) result in their release
to the environment through various waste streams(SRC). The production and
use of magnesium compounds in environmental applications and in

agriculture(1,2) results in their direct release to the environment(SRC).

About 69% of the magnesium compounds used in the United States were used for refractories (e.g., olivine)(1). The remaining 31% of magnesium compounds were used in agriculture as fertilizer or animal feed (e.g, magnesium oxide, magnesium sulfate), as chemical intermediates (e.g., magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium oxide) , construction materials (e.g., magnesium oxide), environmental (e.g., magnesium oxide, magnesium hydroxide), and industrial applications (e.g., magnesium oxide)(1,2). Other uses include road dust and ice control (e.g., magnesium chloride), pulp and paper applications (e.g.,magnesium sulfate), pharmaceuticals (e.g., magnesium sulfate, magnesium carbonate, magnesium oxide), and cosmetics (e.g., magnesium carbonate)(1,2). [(1) Kramer DA; USGS Minerals Yearbook for Magnesium Compounds (2001). Available from http://minerals.usgs.gov/minerals/pubs/commodity/magnesium/magnes01.pdf as of Oct 21, 2002. (2) Kramer DA; USGS Mineral Commodity Summary for Magnesium Compounds (2002). Available from http://minerals.usgs.gov/minerals/pubs/commodity/magnesium/401302.pdf as of Oct 21, 2002.]**PEER REVIEWED**

ENVIRONMENTAL STANDARDS & REGULATIONS:

FIFRA REQUIREMENTS:

As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program, EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Pesticides for which EPA had not issued

Registration Standards prior to the effective date of FIFRA '88 were divided into three lists based upon their potential for human exposure and other factors, with List B containing pesticides of greater concern and List D pesticides of less concern. Magnesium chloride is found on List D.
Case No: 4051; Pesticide type: insecticide (molluscicide), fungicide, herbicide, antimicrobial; Case Status: RED Approved 09/93; OPP has made a decision that some/all uses of the pesticide are eligible for reregistration, as reflected in a Reregistration Eligibility Decision (RED) document.; Active ingredient (AI): magnesium chloride; AI Status: RED Completed - OPP has completed a Reregistration Eligibility Decision (RED) document for the case/AI. [United States Environmental Protection Agency/ Prevention, Pesticides and Toxic Substances; Status of Pesticides in Registration, Reregistration, and Special Review. (1998) EPA 738-R-98-002 317]**PEER REVIEWED**

Residues of magnesium chloride are exempted from the requirement of a tolerance when used as a safener in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest. [40 CFR 180.1001(c); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from: http://www.access.gpo.gov/ecfr as of October 22, 2002]**PEER REVIEWED**

FDA REQUIREMENTS:
Substance added directly to human food affirmed as generally recognized as safe (GRAS). [21 CFR 184.1426; U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from: http://www.access.gpo.gov/ecfr as of October 22, 2002]**PEER REVIEWED**

The Approved Drug Products with Therapeutic Equivalence Evaluations List identifies currently marketed prescription drug products, incl magnesium chloride, approved on the basis of safety and effectiveness by FDA under

sections 505 of the Federal Food, Drug, and Cosmetic Act. [DHHS/FDA;
Electronic Orange Book-Approved Drug Products with Therapeutic Equivalence
Evaluations. Available from: http://fda.gov/cder/ob/ as of April 16, 2003
]**PEER REVIEWED**

ALLOWABLE TOLERANCES:
Residues of magnesium chloride are exempted from the requirement of a
tolerance when used as a safener in accordance with good agricultural
practices as inert (or occasionally active) ingredients in pesticide
formulations applied to growing crops or to raw agricultural commodities
after harvest. [40 CFR 180.1001(c); U.S. National Archives and Records
Administration's Electronic Code of Federal Regulations. Available from:
http://www.access.gpo.gov/ecfr as of October 22, 2002]**PEER REVIEWED**

CHEMICAL/PHYSICAL PROPERTIES:

MOLECULAR FORMULA:
CL2-MG **PEER REVIEWED**

MOLECULAR WEIGHT:
95.21 [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of
Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co.,
Inc., 2001. 1016]**PEER REVIEWED**

COLOR/FORM:
Thin white to gray granules and/or flakes [Lewis, R.J. Sax's Dangerous
Properties of of Industrial Materials. 10th ed. Volumes 1-3 New York, NY:
John Wiley & Sons Inc., 1999.,p. V3 2264]**PEER REVIEWED**

LUSTROUS HEXAGONAL CRYSTALS [Weast, R.C. (ed.). Handbook of Chemistry and
Physics. 60th ed. Boca Raton, Florida: CRC Press Inc., 1979.,p. B-93]**PEER REVIEWED**

Soft leaflets [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of
Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co.,
Inc., 2001. 1016]**PEER REVIEWED**

Colorless or white crystals [Lewis, R.J., Sr (Ed.). Hawley's Condensed

Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc.
1997. 690]**PEER REVIEWED**

BOILING POINT:
1,412 deg C [Lide, DR (ed.). CRC Handbook of Chemistry and Physics. 81st
Edition. CRC Press LLC, Boca Raton: FL 2000,p. 4-70]**PEER REVIEWED**

MELTING POINT:
712 deg C (rapid heating) [O'Neil, M.J. (ed.). The Merck Index - An
Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station,
NJ: Merck and Co., Inc., 2001. 1016]**PEER REVIEWED**

DENSITY/SPECIFIC GRAVITY:
2.32 [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th
ed. New York, NY: John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

SOLUBILITIES:
7.40 g/100 ml of alcohol @ 20 deg C; 72.7 g/100 ml water @ 100 deg C
[Weast, R.C. (ed.). Handbook of Chemistry and Physics. 60th ed. Boca
Raton, Florida: CRC Press Inc., 1979.,p. B-93]**PEER REVIEWED**

In methanol, 15.5 g/100 g @ 0 deg C, 20.4 g/100 g @ 60 deg C; in ethanol,
3.61 g/100 g @ 0 deg C, 15.89 g/100 g @ 60 deg C [Gerhartz, W. (exec ed.).
Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield
Beach, FL: VCH Publishers, 1985 to Present.,p. VA15 (1991) 597]**PEER
REVIEWED**

In water, 54.6 g/100 g @ 20 deg C [Gerhartz, W. (exec ed.). Ullmann's
Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL:
VCH Publishers, 1985 to Present.,p. VA15 (1991) 597]**PEER REVIEWED**

SPECTRAL PROPERTIES:
INDEX OF REFRACTION: 1.675, 1.59 [Weast, R.C. (ed.). Handbook of Chemistry
and Physics. 60th ed. Boca Raton, Florida: CRC Press Inc., 1979.,p.
B-93]**PEER REVIEWED**

OTHER CHEMICAL/PHYSICAL PROPERTIES:
Slow heating releases chlorine @ 300 deg C; attacks fused silica when

melted; easily forms alcoholates and etherates; deliquencent crystals; at 100 deg C loses 2 H2O (17.7%); at 110 deg C begins to lose some HCl; by strong ignition is converted into oxychloride. [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2001. 1016]**PEER REVIEWED**

Deliquescent [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

Heat of fusion: 34.3 kJ/mol; specific heat: 1.415 kJ/kg-K @ 48.6 deg C, 1.537 kJ/kg-K @ 100 deg C [Gerhartz, W. (exec ed.). Ullmann's Encyclopedia of Industrial Chemistry. 5th ed.Vol A1: Deerfield Beach, FL: VCH Publishers, 1985 to Present.,p. VA15 (1991) 598]**PEER REVIEWED**

CHEMICAL SAFETY & HANDLING:

DOT EMERGENCY GUIDELINES:

Fire or explosion: These substances will accelerate burning when involved in a fire. Some may decompose explosively when heated or involved in a fire. May explode from heat or contamination. Some will react explosively with hydrocarbons (fuels). May ignite combustibles (wood, paper, oil, clothing, etc.). Containers may explode when heated. Runoff may create fire or explosion hazard. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

Health: Inhalation, ingestion or contact (skin, eyes) with vapors or substance may cause severe injury, burns, or death. Fire may produce irritating, corrosive and/or toxic gases. Runoff from fire control or dilution water may cause pollution. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government

Printing Office, 2000G-140]**PEER REVIEWED**

Public safety: CALL Emergency Response Telephone Number. ... Isolate spill or leak area immediately for at least 10 to 25 meters (30 to 80 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Keep out of low areas. Ventilate closed spaces before entering. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

Protective clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

Evacuation: ... Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

Fire: Small fires: Use water. Do not use dry chemicals or foams. CO2, or Halon may provide limited control. Large fires: Flood fire area with water from a distance. Move containers from fire area if you can do it without risk. Do not move cargo or vehicle if cargo has been exposed to heat. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. /Magnessium chloride and

Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

Spill or leak: Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. Do not get water inside containers. Small dry spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area. Small liquid spills: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Large spills: Dike far ahead of liquid spill for later disposal. Following product recovery, flush area with water. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

First aid: Move victim to fresh air. Call 911 or emergency medical service. Apply artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes. Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. /Magnessium chloride and Chlorate mixture/ [U.S. Department of Transportation. 2000 Emergency Response Guidebook. RSPA P 5800.8 Edition. Washington, D.C: U.S. Government Printing Office, 2000G-140]**PEER REVIEWED**

HAZARDOUS REACTIVITIES & INCOMPATIBILITIES:
Furan-2-peroxycarboxylic acid ... explodes when heated to 30-40 deg C, or at room temp upon addition of organic or inorganic materials such as ... magnesium chloride. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002.491-90]**PEER REVIEWED**

A large steel evaporator used for magnesium chloride soln was shut down for maintenance. During maintenance operations a fatality occurred from atmospheric oxygen deficiency inside the evaporator. It was found later that the oxygen content in the evaporator fell from the nomral 21% to about 1% in under 24 hr, & this was confirmed in lab tests. This was attributed to very rapid rusting of the steel under warm humid conditions in the presence of traces of magnesium chloride. Further work shows that ... presence of scale is a contributory factor. Magnetite scale (Fe3O4) on mild steel increases the depletion rate by a factor of 10, while the rust formed during the corrosion has little effect. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990 1017]**PEER REVIEWED**

In humid environments it causes steel to rust very rapidly. [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 2078]**PEER REVIEWED**

HAZARDOUS DECOMPOSITION:
When heated to decomp ... emits toxic fumes of /hydrogen chloride/. [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996. 2078]**PEER REVIEWED**

DISPOSAL METHODS:
SRP: At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (including waste sludge), consult with environmental regulatory agencies for guidance on acceptable disposal practices. **PEER REVIEWED**

OCCUPATIONAL EXPOSURE STANDARDS:

MANUFACTURING/USE INFORMATION:

MAJOR USES:
Source of magnesium metal, disinfectants, fire extinguishers, fireproofing wood, magnesium oxychloride cement, refrigerating brines, ceramics, cooling drill tools, textiles (size, dressing and filling of cotton and woolen fabrics, thread lubricant, carbonization of wool), paper manufacture, road dust-laying compounds, floor-sweeping compounds, flocculating agent, catalyst. [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

MEDICATION (VET) **PEER REVIEWED**

AS ADDITION TO CASEIN GLUE; IN DISINFECTANTS; FLOOR-SWEEPING CMPDS; CATHARTIC [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2001. 1016]**PEER REVIEWED**

For magnesium chloride (USEPA/OPP Pesticide Code: 013902) ACTIVE products with label matches. /SRP: Registered for use in the U.S. but approved pesticide uses may change periodically and so federal, state and local authorities must be consulted for currently approved uses./ [U.S. Environmental Protection Agency/Office of Pesticide Program's Chemical Ingredients Database on Magnesium Chloride (7786-30-3). Available from the Database Query page at http://www.cdpr.ca.gov/docs/epa/epamenu.htm as of October 23, 2002.]**PEER REVIEWED**

Magnesium chloride is a component of fire extinguishers, ceramics, textile and paper manufacture. [International Labour Office. Encyclopaedia of Occupational Health and Safety. 4th edition, Volumes 1-4 1998. Geneva, Switzerland: International Labour Office, 1998.63.24]**PEER REVIEWED**

MANUFACTURERS:
Great Salt Lake Minerals Corp., 8300 College Blvd., Shawnee Mission, KS 66210, (913) 344-9100; Production site: Little Mountain, UT 84404 [SRI International. 2002 Directory of Chemical Producers. SRI Consulting, Menlo

Park, CA. 2002. 699]**PEER REVIEWED**

Magnesium Corp. of America, 238 North 2200 West, Salt Lake City, UT 84116,
(801) 532-2043; Production site: Rowley, UT 84116 [SRI International. 2002
Directory of Chemical Producers. SRI Consulting, Menlo Park, CA. 2002.
699]**PEER REVIEWED**

Mineral Research and Development, One Woodlawn Green, 200 East Woodlawn
Rd., Suite 250, Charlotte, NC 28217, (704) 525-2771; Production site:
Harrisburg, NC 28075 [SRI International. 2002 Directory of Chemical
Producers. SRI Consulting, Menlo Park, CA. 2002. 699]**PEER REVIEWED**

Reilly Industries, Inc., 300 N. Meridian St., Suite 1500, Indianapolis, IN
46204-1763, (317) 248-6411; Production site: Wendover, UT 84083 [SRI
International. 2002 Directory of Chemical Producers. SRI Consulting, Menlo
Park, CA. 2002. 699]**PEER REVIEWED**

Titanium Metals Corp., 1999 Broadway, Suite 4300, Denver, CO 80202, (303)
296-5600; Production site: Henderson, NV 89009 [SRI International. 2002
Directory of Chemical Producers. SRI Consulting, Menlo Park, CA. 2002.
699]**PEER REVIEWED**

Western Salt Co., 7220 Trade St. No. 300, San Diego, CA 92121, (858)
566-6600; Production site: Chula Vista, CA 91911 [SRI International. 2002
Directory of Chemical Producers. SRI Consulting, Menlo Park, CA. 2002.
699]**PEER REVIEWED**

METHODS OF MANUFACTURING:
ACTION OF HYDROCHLORIC ACID ON MAGNESIUM OXIDE OR HYDROXIDE, ESPECIALLY
THE LATTER WHEN PRECIPITATED FROM SEAWATER OR BRINES (GREAT SALT LAKE)
[Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed.
New York, NY: John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

... PREPARED FROM MAGNESIUM AMMONIUM CHLORIDE HEXAHYDRATE IN PRESENCE OF
HCL ... . [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of

Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co., Inc., 2001. 1016]**PEER REVIEWED**

METHOD OF PURIFICATION: RECRYSTALLIZATION. [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

Molten magnesium chloride can be formed by the direct carbochlorination of magnesium oxide obtained from the calcination of magnesium carbonate ores or magnesium hydroxide. [Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present.V15 626 (1995)]**PEER REVIEWED**

Magnesium chloride can be produced in large quantities from (1) carnallite or the end brines of the potash industry; (2) magnesium hydroxide precipitated from seawater; (3) by chlorination of magnesium oxide from various sources in the presence of carbon or carbonaceous materials; and (4) as a by-product in the manufacture of titanium. [Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present.V15 686 (1995)]**PEER REVIEWED**

GENERAL MANUFACTURING INFORMATION:
PARENTERALLY, AS SOURCE OF MG. READILY AVAIL SOURCE OF MG ON ORAL DOSING IN CATTLE. STABILIZES LIQUID SUSPENSIONS OF LIVER VIRUSES &... SERVES AS BACTERIOSTATIC & MYCOSTATIC AGENT. IN LABORATORIES, TO "ANESTHETIZE" PROTOZOA.../& LEECHES/. ...ITS USE IS AVOIDED AS DIETARY SUPPLEMENT. [Rossoff, I.S. Handbook of Veterinary Drugs. New York: Springer Publishing Company, 1974. 319]**PEER REVIEWED**

FORMULATIONS/PREPARATIONS:
GRADES: TECHNICAL (CRYSTALS, FUSED, FLAKES, GRANULATED), CP. [Lewis, R.J., Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY: John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

AEROTEX ACCELERATOR MX **PEER REVIEWED**

MAGNOGENE [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co.,

Inc., 2001. 1016]**PEER REVIEWED**

U. S. PRODUCTION:
(1972) 8.63X10+11 GRAMS [SRI]**PEER REVIEWED**

U. S. IMPORTS:
(1972) 2.47X10+8 GRAMS [SRI]**PEER REVIEWED**

(1974) 2.2X10+8 GRAMS [SRI]**PEER REVIEWED**

(1989) 5994 metric tons [Kirk-Othmer Encyclopedia of Chemical Technology.
4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present.V15 687
(1995)]**PEER REVIEWED**

(1990) 6914 metric tons [Kirk-Othmer Encyclopedia of Chemical Technology.
4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present.V15 687
(1995)]**PEER REVIEWED**

U. S. EXPORTS:
(1990) 4763 metric tons [Kirk-Othmer Encyclopedia of Chemical Technology.
4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present.V15 687
(1995)]**PEER REVIEWED**

(1989) 2201 metric tons [Kirk-Othmer Encyclopedia of Chemical Technology.
4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present.V15 687
(1995)]**PEER REVIEWED**

LABORATORY METHODS:

SYNONYMS AND IDENTIFIERS:

RELATED HSDB RECORDS:
654 [MAGNESIUM, ELEMENTAL; 7439-95-4]

7065 [MAGNESIUM COMPOUNDS]

SYNONYMS:
USEPA/OPP Pesticide Code: 013902 [U.S. Environmental Protection Agency/Office of Pesticide Program's Chemical Ingredients Database on
Magnesium Chloride (7786-30-3). Available from the Database Query page at
http://www.cdpr.ca.gov/docs/epa/epamenu.htm as of October 23, 2002.]**PEER
REVIEWED**

MAGNESIUM CHLORIDE [MG2CL4]**PEER REVIEWED**

MAGNESIUM CHLORIDE [MGCL2]**PEER REVIEWED**

MAGNESIUM DICHLORIDE **PEER REVIEWED**

ASSOCIATED CHEMICALS:
MAGNESIUM CHLORIDE HEXAHYDRATE; 7791-18-6

FORMULATIONS/PREPARATIONS:
GRADES: TECHNICAL (CRYSTALS, FUSED, FLAKES, GRANULATED), CP. [Lewis, R.J.,
Sr (Ed.). Hawley's Condensed Chemical Dictionary. 13th ed. New York, NY:
John Wiley & Sons, Inc. 1997. 690]**PEER REVIEWED**

AEROTEX ACCELERATOR MX **PEER REVIEWED**

MAGNOGENE [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of
Chemicals, Drugs, and Biologicals. Whitehouse Station, NJ: Merck and Co.,
Inc., 2001. 1016]**PEER REVIEWED**

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