RIBAVIRIN ORAL SOLUTION

MERCK

Revised: 11/30/2011

MSDS | **Material Safety Data Sheet**

MSD
Rathdrum,
Co. Wicklow, Ireland

SAFETY DATA SHEET

Merck urges each user or recipient of this SDS to read the entire data sheet to become aware of the hazards associated with this material.

SECTION 1. IDENTIFICATION OF SUBSTANCE AND CONTACT INFORMATION

SDS NAME: **Ribavirin Oral Solution**

SYNONYM(S): Rebetol Oral Solution
Rebetol Syrup
Rebetol Sirop

SDS Number: SP000191

EMERGENCY NUMBER(S): +1 (908) 423-6000 (24/7/365) English Only

++353-404-46209 MSD (Avondale)

EU Transportation Emergencies - Carechem24:
+44 (0)208 762 8322 (24 hours/7 days/week)

MERCK SDS HELPLINE: +1 (908) 473-3371 (Worldwide)
Monday to Friday, 9am to 5pm (US Eastern Time)

SDS EMAIL: mercksds@merck.com

SECTION 2. HAZARDS IDENTIFICATION

EU CLASSIFICATION(S): R43 Muta. Cat.3;R68

EMERGENCY OVERVIEW

Clear, Colorless to light yellow
Liquid
Bubblegum odor
May be harmful by inhalation.
May cause skin sensitization in sensitive individuals.
May be irritating to eyes, skin or respiratory tract.
May cause developmental effects.
May cause reproductive effects.
May cause effects to:
respiratory system
male reproductive system
cardiovascular system
gastrointestinal tract
immune system
skin
blood
liver
kidney
fetus

POTENTIAL HEALTH EFFECTS:

The following summary is based upon available information about the individual ingredients of the mixture, or of the expected properties of the mixture.

Ribavirin Capsules and Oral Solution are indicated in combination with Intron A and Peg-Intron injection for the treatment of chronic hepatitis C. Ribavirin, the active ingredient, is an antiviral drug indicated in the treatment of viral infections.

The primary toxicity of ribavirin in humans is hemolytic anemia. Anemia is dose- and time-dependent. Ribavirin-induced anemia is normally reversible within 2-4 weeks following discontinuation of treatment. Treatment of patients with ribavirin by inhalation has sometimes led to deterioration in pulmonary function, bacterial pneumonia, and pneumothorax. Additionally, adverse cardiovascular effects including a fall in blood pressure and cardiac arrest have occurred. Adverse effects from occupational inhalation exposure to ribavirin in health-care personnel have been reported; the most common effects were headache, conjunctivitis, rhinitis or nasal congestion, nausea, rash, dizziness, pharyngitis, or lacrimation. Minor abnormalities in pulmonary function or exacerbation of bronchospasm or chest pain in workers with pre-existing reactive airway disease (COPD or asthma) were also observed. Additionally, damage to soft contact lenses following repeated occupational exposure to ribavirin has been reported. Most reported effects in workers resolved within minutes to hours of removal from exposure to ribavirin. Significant adverse effects observed in patients receiving combination therapy of ribavirin and intron A include severe depression and suicidal thoughts, bone marrow suppression, autoimmune and infectious disorders, pulmonary dysfunction, or inflammation of the pancreas. Other effects reported in these patients following oral dosing include an increase in the circulation of newly formed red blood cells (reticulocytosis), anorexia, upset stomach, nausea, dizziness, insomnia, irritability, shortness of breath, pharyngitis, fatigue, headache, skin rashes and itching.

Sucrose is not expected to produce significant toxicity with workplace handling. Sucrose has been associated with dermatis upon repeated exposure and it may cause irritation to the eyes, skin, and mucous membranes from mechanical action. However, sucrose is not expected to cause irritation in this mixture.

Glycerin may cause eye, skin, or respiratory tract irritation. Long-term administration of glycerin caused kidney effects in animals.

Sorbitol is not expected to produce significant toxicity with workplace handling. Ingestion of large amounts may cause gastrointestinal effects (e.g. abdominal cramping, diarrhea, vomiting, or bloating). Other effects secondary to fluid and electrolyte imbalances that may occur following ingestion of large amounts include dehydration, electrolyte abnormalities, or decreased blood pressure.

Propylene glycol is considered to be relatively non-toxic. It is a mild irritant to the eyes and has been reported to irritate the skin. It may cause skin sensitization resulting in allergic contact dermatitis in susceptible individuals. Inhalation exposure to saturated and supersaturated atmospheres of propylene glycol for prolonged periods of time produced no adverse effects. Propylene glycol may cause nervous system depression, acidosis, stupor, and seizures after chronic ingestion.

LISTED CARCINOGENS

No carcinogens or potential carcinogens listed by IARC or EU Directive 90/394 (Annex I) in this mixture.

SECTION 3. COMPOSITION AND INFORMATION ON INGREDIENTS

PRODUCT USE: Drug product

CHEMICAL FORMULA: Mixture.

The formulation for this product is proprietary information. Only hazardous ingredients in concentrations of 1% or greater and/or carcinogenic ingredients in concentrations of 0.1% or greater are listed in the Chemical Composition table. Active ingredients in any concentration are listed. For additional information about carcinogenic ingredients see Section 2.

CHEMICAL COMPOSITION

INGREDIENT	CAS NUMBER	EC NUMBER	EU CLASSIFICATION	PERCENT
Sucrose	57-50-1	200-334-9	Not Classified	30-40
Glycerin	56-81-5	200-289-5	Not Classified	10-20
Sorbitol	50-70-4	200-061-5		10-20
Propylene Glycol	57-55-6	200-338-0		10-20
Ribavirin	36791-04-5		Repr. Cat.3;R62-63 Muta. Cat.3;R68 R43 Xi;R36/37 Xn;R48/22 R52-53	4

ADDITIONAL INFORMATION: This MSDS is written to provide health and safety information for individuals who will be handling the final product formulation during research, manufacturing, and distribution. For health and safety information for individual ingredients used during manufacturing, refer to the appropriate MSDS for each ingredient. Refer to the package insert or product label for handling guidance for the consumer.

See section 15 for EU hazard classification symbols and risk and safety phrases.

SECTION 4. FIRST AID MEASURES

INHALATION: Remove to fresh air. If any trouble breathing, get immediate medical attention. Administer artificial respiration if breathing has ceased. If irritation or symptoms occur or persist, consult a physician.

SKIN CONTACT: In case of skin contact, while wearing protective gloves, carefully remove any contaminated clothing, including shoes, and wash skin thoroughly with soap and water. If irritation or symptoms occur or persist, consult a physician.

EYE CONTACT: In case of eye contact, immediately rinse eyes thoroughly with plenty of water. If wearing contact lenses, remove only after initial rinse, and continue rinsing eyes for at least 15 minutes. If irritation occurs or persists, consult a physician.

INGESTION: Rinse mouth and drink a glass of water. Do not induce vomiting unless under the direction of a qualified medical professional or Poison Control Center. If symptoms persist, consult a physician.

SECTION 5. FIRE FIGHTING MEASURES

FLAMMABILITY DATA:

Flash Point: Not determined (liquids) or not applicable (solids).

SPECIAL FIRE FIGHTING PROCEDURES:
Wear full protective clothing and self-contained breathing apparatus (SCBA).

SUITABLE EXTINGUISHING MEDIA:
Carbon dioxide (CO2), extinguishing powder or water spray.

See Section 9 for Physical and Chemical Properties.

SECTION 6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:
Keep personnel away from the clean-up area. Wear appropriate personal protective equipment as specified in Section 8.

SPILL RESPONSE / CLEANUP:
Ensure adequate ventilation. All spills should be handled according to site requirements and based on precautions cited in the MSDS. In the case of liquids, use proper absorbent materials. For laboratories and small-scale operations, incidental spills within a hood or enclosure should be cleaned by using a HEPA filtered vacuum or wet cleaning methods as appropriate. For large dry or liquid spills or those spills outside enclosure or hood, appropriate emergency response personnel should be notified. In manufacturing and large-scale operations, HEPA vacuuming prior to wet mopping or cleaning is required.

See Sections 9 and 10 for additional physical, chemical, and hazard information.

SECTION 7. HANDLING AND STORAGE

PRECAUTIONS FOR SAFE HANDLING

HANDLING:
Keep containers adequately sealed during material transfer, transport, or when not in use. Wash face, hands, and any exposed skin after handling. Do not eat, drink, or smoke when using this substance or mixture.

Appropriate handling of this material is dependent on many factors, including physical form, duration and frequency of process or task, and effectiveness of engineering controls. Site-specific risk assessments should be conducted to determine the feasibility and the appropriateness of all exposure control measures. See Section 8 (Exposure Controls) for additional guidance.

CONDITIONS FOR SAFE STORAGE, INCLUDING ANY IMCOMPATIBILITIES

STORAGE:
Store in a cool, dry, well ventilated area.

SPECIFIC END USE(S)
Refer to Section 1 for identified use(s).

See Section 8 for exposure controls and additional safe handling information.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

The following guidance applies to the handling of the active ingredient(s) in this formulation.

OCCUPATIONAL EXPOSURE BAND (OEB):
OEB 3: 10-100 mcg/m^3. Materials in an OEB 3 category are considered moderate health hazards. The OEB is a range of airborne concentrations expressed as an 8-hour Time Weighted Average (8-hr. TWA) and is intended to be used with Industrial Hygiene Risk Assessment to assist with industrial hygiene sampling and selection of proper controls for worker protection. Consult your site safety and industrial hygiene staff for guidance on handling and control strategies.

OCCUPATIONAL EXPOSURE GUIDELINE (OEG):
An Occupational Exposure Guideline of 15 mcg/m^3 (8-hr TWA) has been established for ribavirin. Consult your site safety and industrial hygiene professional(s) for additional guidance.

EXPOSURE CONTROLS
The health hazard risks of handling this material are dependent on many factors, including physical form, duration and frequency of process or task, and effectiveness of engineering controls. Site-specific risk assessments should be conducted to determine the feasibility and the appropriateness of all exposure control measures. Exposure controls for normal operating or routine procedures follow a tiered strategy. Engineering controls are the preferred means of long-term or permanent exposure control. If engineering controls are not feasible, appropriate use of personal protective equipment (PPE) may be considered as alternative control measures. Exposure controls for non-routine operations must be evaluated and addressed as part of the site-specific risk assessment.

RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE):

Respiratory Protection: Respiratory protective equipment (RPE) may be required for certain laboratory and large-scale manufacturing tasks if potential airborne breathing zone concentrations of substances exceed the relevant exposure limit(s). Workplace risk assessment should be completed before specifying and implementing RPE usage. Potential exposure points and pathways, task duration and frequency, potential employee contact with the substance, and the ability of the substance to be rendered airborne during specific tasks should be evaluated. Initial and ongoing strategies of quantitative exposure measurement should be obtained as required by the workplace risk assessment. All RPE must conform to local and regional specifications for efficacy and performance. Consult your site or corporate health and safety professional for additional guidance.

Skin Protection: Gloves that provide an appropriate barrier to the skin are recommended if there is potential for contact with this material. Consult your site safety staff for guidance.

Eye Protection: Safety glasses with side shields. Use of goggles or full face protection may be required based on hazard, potential for contact, or level of exposure. Consult your site safety staff for guidance.

Body Protection: In small-scale or laboratory operations, lab coats or equivalent protection is required. Disposable Tyvek or other dust impermeable suit should be considered based on procedure or level of exposure. Use of additional PPE such as shoe coverings, gauntlets, hood, or head covering may be necessary. Consult your site safety staff for guidance.

In large-scale or manufacturing operations, disposable Tyvek or other dust impermeable suit is recommended and based on level of exposure. Use of additional PPE such as shoe coverings, gauntlets, hood, or head covering may be necessary. Consult your site safety staff for guidance.

EXPOSURE LIMIT VALUES:

INGREDIENT	CAS NUMBER	ACGIH TLV (TWA)	ACGIH TLV (STEL / SKIN)	ACGIH TLV (CEIL)
Sucrose	57-50-1	10 mg/m^3		
Glycerin	56-81-5	10 mg/m^3		

INGREDIENT	CAS NUMBER	EU	Austria	Belgium	Denmark	France
Sucrose	57-50-1			TWA 10 mg/m^3		VME 10 mg/m^3
Glycerin	56-81-5			TWA 10 mg/m^3		VME 10 mg/m^3

INGREDIENT	CAS NUMBER	Germany	Ireland	Italy	Netherlands
Sucrose	57-50-1		STEL 20 mg/m^3 TWA 10 mg/m^3		
Glycerin	56-81-5	MAK 50 mg/m^3 Peak 100 mg/m^3	TWA 10 mg/m^3		
Propylene Glycol	57-55-6		TWA 150 ppm TWA 470 mg/m^3 TWA 10 mg/m^3		

INGREDIENT	CAS NUMBER	Norway	Portugal	Spain	Switzerland	UK:
Sucrose	57-50-1		TWA 10 mg/m^3	VLA-ED 10 mg/m^3		STEL 20 mg/m^3 TWA 10 mg/m^3
Glycerin	56-81-5		TWA 10 mg/m^3	VLA-ED 10 mg/m^3	STEL 100 mg/m^3 MAK 50 mg/m^3	STEL 30 mg/m^3 TWA 10 mg/m^3
Propylene Glycol	57-55-6	STEL 37.5 ppm STEL 118.5 mg/m^3 TWA 25 ppm TWA 79 mg/m^3				STEL 450 ppm STEL 1422 mg/m^3 STEL 30 mg/m^3 TWA 150 ppm TWA 474 mg/m^3 TWA 10 mg/m^3

See occupational exposure guideline (OEG) listed above.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

FORM: Liquid
COLOR: Clear, Colorless to light yellow
ODOR: Bubblegum odor
pH: 4.8-5.5
SPECIFIC GRAVITY: 1.18-1.25

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

SOLUBILITY:

Water: Not determined

See Section 5 for flammability/explosivity information.

SECTION 10. STABILITY AND REACTIVITY

STABILITY/ REACTIVITY:
Stable under conditions specified in Section 7 of this SDS. No hazardous reactions known.

CONDITIONS AND MATERIALS TO AVOID:
None known.

HAZARDOUS DECOMPOSITION PRODUCTS / REACTIONS:
No dangerous decomposition is expected if used according to manufacturer's specifications.

SECTION 11. TOXICOLOGICAL INFORMATION

The information presented below pertains to the following individual ingredients, and not to the mixture(s).

ACUTE TOXICITY DATA

INHALATION:
Glycerin: Inhalation LC50 (1hr): >570 mg/m^3 [>0.57 mg/L] (rat)

Propylene glycol caused no adverse effects in monkeys or rats following exposure to saturated atmospheres for prolonged periods of time.

SKIN:
Glycerin: Skin LD50: >10,000 mg/kg (rabbit)
Glycerin was slightly irritating to the skin of rabbits.

Propylene glycol: Dermal LD50: 20.8 g/kg (rabbit)
Propylene glycol was irritating in a human patch test. Propylene glycol was not irritating to the skin of rabbits, guinea pigs and swine.

EYE:
Glycerin was slightly irritating to the eyes of rabbits.

Propylene glycol was slightly irritating to the eyes of rabbits.

ORAL:
Ribavirin is not acutely toxic in animals by oral or parenteral routes of administration. Single-dose studies have been conducted in mice, rats, guinea pigs and dogs with oral LD50 values ranging from 2 to 10 g/kg. Single oral doses up to 750 mg/kg ribavirin were well tolerated in dogs whereas a single dose of 1.5 g/kg was lethal. Autopsies of dogs that died following the 1.5 g/kg dose revealed damage to the GI mucosa, kidneys, and heart; death was attributed to cardiac insufficiency secondary to GI hemorrhage and large blood loss. Gastrointestinal effects were the most common effects seen in all species. These effects included loose mucoid or bloody stools or dark red material in the lumina of the gut from GI hemorrhage. Blood was present in oral, nasal, and urogenital discharges. Other common effects across species included thymic hemorrhage, hunched posture, depression, prostration and rough coat.

Sucrose: Oral LD50: 29,700 mg/kg (rat)
Clinical signs of toxicity observed include hypokinesia, prostration, cyanosis, convulsions, abdominal bloating, and diarrhea. Death results from respiratory failure.

Glycerin: Oral LD50: 12,600 mg/kg (rat)

Sorbitol: Oral LD50: 15,900 mg/kg (rat); 17,800 mg/kg (mouse)

Propylene glycol: Oral LD50: 21 to 33.7 g/kg (rat), 10 to 20 g/kg (dog)
Propylene glycol caused dyspnea, cramps, loss of equilibrium, depression, analgesia, and death after prolonged moribund state in mice at doses ranging from 23.9 to 31.8 g/kg. In rabbits, 1 to 1.5 g/kg propylene glycol reduced intraocular pressure by raising the osmotic pressure of blood.

DERMAL AND RESPIRATORY SENSITIZATION:
Propylene glycol did not cause sensitization in a human patch test.

REPEAT DOSE TOXICITY DATA

SUBCHRONIC / CHRONIC TOXICITY:
Decreased body weight, food consumption, and alkaline phosphatase and perivascular mononuclear cell infiltration in the lungs were observed in a six-week inhalation study with ribavirin in rats [NOEL 0.055 mg/L or 7.6 mg/kg].

Repeated oral and parenteral dose studies with ribavirin from 10 days to 24 months resulted in a consistent pattern of effects observed across all species tested (mice, rats, cats, dogs and monkeys). The most significant reported effect was anemia and reduction in hemoglobin and hematocrit which was observed in all species tested. The severity of anemia associated with prolonged ribavirin treatment varies among species. Sensitivity to this effect is greatest in monkeys and least in rodents. The response in man is similar to but less sensitive then monkeys in developing ribavirin-induced anemia. Ribavirin appears to reduce circulating red blood cells and red blood cell survival as well as inhibit the release of late stage erythrocytes from the bone marrow. Slight effects on various clinical chemistry parameters have also been observed across species. All effects were reversible within three weeks to two months after cessation of drug treatment. The NOAEL in a 52-week oral dosing study in dogs was 5 mg/kg due to slight reduction without histopathic changes in red blood cells. The NOEL in a one year oral dosing study in rats was 10 mg/kg.

Consistent with the results of acute toxicity studies with ribavirin, gastrointestinal effects were the most common effects seen in animals. In short-term studies of less than 1 month duration, effects seen were generally loose and bloody stools with histopathic evidence of enteritis. In studies of duration greater than ninety days, clinical signs of enteritis were variable and gastrointestinal pathology was not evident. Other common effects seen across species tested included decreased body weight and body weight gain, thymic weight reduction, thymic lymphocyte depletion, slight increases in platlet counts, and increases in activated partial thromboplastin times [APTT]. Effects on the liver, heart, lungs, salivary gland, spleen, testes, thymus and lymph nodes have been reported at doses of ribavirin greater than 20 mg/kg administered for 28 days or longer.

Glycerin caused calcification in the renal tubules in rats given 5% concentration of glycerin in the drinking water for 6 months.

Long-term feeding studies performed in rats that ingested 20% of their daily intake as sorbitol resulted in unilateral and bilateral hyperplasia of the adrenal medulla as well as a decrease in thyroid gland weight.

Propylene glycol caused no adverse effects in monkeys or rats exposed to saturated vapor concentrations for 12 to 18 months. Rats exposed to 25 or 50% (7.7 and 13.2 g/kg/day) propylene glycol in water died within 69 days in a 140 day study. In a separate study, a diet of 30% propylene glycol was not well tolerated in young rats, and dams could not bring their young to weaning; diets containing 40, 50, or 60% propylene glycol were lethal after a few days.

REPRODUCTIVE / DEVELOPMENTAL TOXICITY:
General reproduction and fertility, teratology and peri- or post-natal effects studies were all conducted with ribavirin. Ribavirin has caused embryocidal and/or teratogenic effects at doses well below the recommended human clinical dose (10-15 mg/kg) in a number of animal species tested. Rabbits and rats were the most sensitive to the teratogenic effects of ribavirin. The lowest reported developmental NOEL from teratology studies in both the rabbit and rat was 0.3 mg/kg.

Ribavirin has been shown to be a male reproductive toxin and toxic to lactating animals and their offspring. In rats, ribavirin significantly decreased sperm count, at doses of 20-200 mg/kg, in a dose- and time-dependent fashion. Recovery from sperm count reduction was seen in the low and mid-dose groups by 105 days post treatment, but this effect was not reversible at the high dose of 200 mg/kg. Male mice were dosed with up to 150 mg/kg for six months. All doses in this study caused an effect on spermatid counts and sperm morphology and function. Essentially, total recovery from ribavirin-induced testicular toxicity was observed within one to two spermatogenesis cycles following cessation of treatment [LOEL 35 mg/kg/day]. Ribavirin was clinically well-tolerated when administered to male mice at single daily oral doses of 1-75 mg/kg for three months, although ribavirin reduced the numbers of testicular spermatids and caudal epididymal sperm at 15 mg/kg and greater. Based on sperm morphology changes, the NOEL was 1 mg/kg in this study.

In an inhalation study evaluating the effects of ribavirin on developing mammalian lungs in ferrets, lactation failure with secondary malnutrition in kits and liver discoloration were reported [NOEL 162 mg/m^3].

Sucrose produced fetal skeletal changes in guinea pigs exposed to high concentrations (5 to 10 g/kg); however, no effects were seen in rats exposed to 10 g/kg/day.

Glycerin injected into the testes of rats suppressed sperm production; however, oral administration of 100 mg/kg had no effect on fertility.

In rats fed a diet of 20% sorbitol, the duration of gestation was increased and litter sizes were reduced. Sorbitol was not teratogenic in either rats or rabbits.

Propylene glycol caused decreased food consumption, retarded growth, smaller litters, changes in breeding patterns, and inhibited weaning in rats that were fed 30% propylene glycol through six generations; however, this may have been due to nutritional insufficiency. Propylene glycol was not teratogenic in rabbits, monkeys or chickens.

MUTAGENICITY / GENOTOXICITY:
Mutagenicity and genotoxicity study results for ribavirin are equivocal. Ribavirin was negative in a bacterial mutagenicity assay (Ames), chromosomal aberration assay in human peripheral blood lymphocytes, and a dominant lethal study in rats. However, ribavirin produced a dose-related increase in mutant frequencies in the mouse lymphoma assay and in a mouse micronucleus assay within the clinical dose range. It also caused an increase in transformations at the highest dose tested in the Balb/3T3 transformation assay although there was no evidence of a dose response.

Sucrose was negative in a variety of mutagenicity assays.

Glycerin was negative in a bacterial mutagenicity study (Ames). Glycerin was positive in chromosome aberration studies in rat bone marrow and sperm cells; however, it was negative in an occupational cytogenetics chromosome aberration study.

Propylene glycol was negative in a bacterial mutagenicity study (Ames).

CARCINOGENICITY:
This material or product has not been evaluated for carcinogenicity.

Carcinogenicity studies in male and female rats and mice were conducted with orally administered ribavirin at doses of 10-75 mg/kg/day. Administration of ribavirin did not increase the incidence of tumors compared to controls in either species and it was concluded that ribavirin was not oncogenic to rats and mice given doses at 2.6 to 5 times the human dose.

Additionally, the carcinogenic potential of ribavirin was assessed in p53 (+/-) transgenic mice administered oral daily doses of 75 to 300 mg/kg for at least 26 weeks. There was no evidence of tumorigenicity, mortality or clinical observations at any dose tested in the ribavirin-treated mice in this study. A dose-dependent increase in red blood cell distribution width (RDW) values was observed as a treatment-related effect. Male mice had slightly lower absolute and relative mean testes and epididymide weights in all three dose groups compared to controls. Ribavirin-related histopathologic findings included minimal to mild increased extramedullary hematopoiesis of the spleens of both sexes in all three dose groups. Other effects of note include minimal seminiferous tubular degeneration of the testes and minimal to severe hypospermia of the epididymides from all three dose groups.

Sucrose was not carcinogenic in mice and rats exposed to 10% in the diet for 18 months; however, sucrose showed tumor promoting activity in mice.

SECTION 12. ECOLOGICAL INFORMATION

There are no data for the final product or its formulation(s). The information presented below pertains to the following ingredient(s).

ECOTOXICITY DATA

INGREDIENT ECOTOXICITY

Ribavirin: 96-hr LC50 (fish): >119 mg/L
Ribavirin: 48-hr EC50 (daphnid): >117 mg/L
Ribavirin: 72-hr IC50 (algae): 72 mg/L
Glycerin: 96-hr LC50 (trout): 50-67 mg/L
Glycerin: 96-hr LC50 (goldfish): >5000 mg/L
Glycerin: 8-day EC50 (algae): 2900 mg/L
Propylene glycol: 96-hr LC50 (sheepshead minnow): 23,800 mg/L
Propylene glycol: 48-hr EC50 (daphnid): >43,500 mg/L
Propylene glycol: 72-hr EC50 (green algae): >19,000 mg/L

ENVIRONMENTAL DATA

OTHER INGREDIENT ENVIRONMENTAL DATA:

Ribavirin: n-Octanol/Water Partition Coefficient (log Pow): 0.971
Ribavirin: Activated Sludge Respiration Inhibition Test: 0% (3-hr inhibition)
Ribavirin: Biodegredation: Not readily biodegradable.

Propylene glycol is expected to be readily biodegradable.

SECTION 13. DISPOSAL CONSIDERATIONS

WASTE TREATMENT METHODS

MATERIAL WASTE:
Disposal must be in accordance with applicable federal, state/provincial, and/or local regulations. Incineration is the preferred method of disposal, when appropriate. Operations that involve the crushing or shredding of waste materials or returned goods must be handled to meet the recommended exposure limit(s).

PACKAGING AND CONTAINERS:
Disposal must be in accordance with applicable federal, state/provincial, and/or local regulations.

SECTION 14. TRANSPORT INFORMATION

This material is not subject to the transportation regulations of DOT, IATA, IMO, and the ADR.

SECTION 15. REGULATORY INFORMATION

The following classification is based on available data and is in accordance with European Union criteria.

EUROPEAN UNION REGULATIONS:

Indication of Danger: Xn - Harmful.

Risk Phrases:
R43 - May cause sensitization by skin contact.
R68 - Possible risks of irreversible effects.
S24/25 - Avoid contact with skin and eyes.
S36/37 - Wear suitable protective clothing and gloves.

SECTION 16. OTHER INFORMATION

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained therein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequence of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

DEPARTMENT ISSUING MSDS:
Global Safety & the Environment
Merck & Co., Inc.
One Merck Drive
Whitehouse Station, NJ 08889

MERCK SDS HELPLINE:
+1 (908) 473-3371 (Worldwide)
Monday to Friday, 9am to 5pm (US Eastern Time)

MSDS CREATION DATE: 04-May-2004
SUPERSEDES DATE: 21-Mar-2008

SECTIONS CHANGED (EU SUBFORMAT): 1, 16
SIGNIFICANT CHANGES (EU SUBFORMAT): Phone Number(s), OEB