SAFETY DATA SHEET

Updated on 26/09/2024

1. Material Identification

Product Name : Chlorpyrifos
Catalog Number : io-1998
CAS Number : 2921-88-2
Identified uses : Laboratory chemicals, manufacture of chemical compounds
Company : Ionz

>> R&D Use only

2. Hazards Identification

GHS Classification:

Flammable liquid (category 2)
Acute toxicity, oral (Category 3)
Acute toxicity, dermal (Category 3)
Acute toxicity, inhalation (Category 3)
Specific target organ toxicity, single exposure (Category 1)

Pictogram(s)

GHS Hazard Statements

>> H301 (100%): Toxic if swallowed [Danger Acute toxicity, oral]

>> H312 (13.7%): Harmful in contact with skin [Warning Acute toxicity, dermal]

>> H319 (13.7%): Causes serious eye irritation [Warning Serious eye damage/eye irritation]

>> H330 (15.9%): Fatal if inhaled [Danger Acute toxicity, inhalation]

>> H400 (100%): Very toxic to aquatic life [Warning Hazardous to the aquatic environment, acute hazard]

>> H410 (100%): Very toxic to aquatic life with long lasting effects [Warning Hazardous to the aquatic environment, long-term hazard]

Precautionary Statement Codes

>> P260, P264, P264+P265, P270, P271, P273, P280, P284, P301+P316, P302+P352, P304+P340, P305+P351+P338, P316, P317, P320, P321, P330, P337+P317, P362+P364, P391, P403+P233, P405, and P501

Health Hazards:

>> Symptoms of organophosphate insecticide poisoning: cholinesterase inhibition, headache, fatiguedizziness, blurred vision, weakness, nausea, cramps, diarrhea, chest discomfort, sweating, miosis, tearing, salivation, vomiting, cyanosis, papilledema, and muscle twitching. In advanced cases convulsions, coma, loss of reflexes, and loss of sphincter control may occur. EYES: Can produce mild to moderate eye irritation and transient corneal injury. SKIN: Undiluted liquid products can cause skin irritation. Prolonged or repeated exposure may cause superficial burns. (USCG, 1999)

>> Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

>> Combustible material: may burn but does not ignite readily. Containers may explode when heated. Those substances designated with a (P) may polymerize explosively when heated or involved in a fire. Runoff may pollute waterways. Substance may be transported in a molten form. (ERG, 2024)

>> Combustible. Gives off irritating or toxic fumes (or gases) in a fire. Liquid formulations containing organic solvents may be flammable. Risk of fire and explosion if formulations contain flammable/explosive solvents.

3. Composition/Information On Ingredients

Chemical name : Chlorpyrifos
CAS Number : 2921-88-2
Molecular Formula : C9H11Cl3NO3PS
Molecular Weight : 350.6000 g/mol

4. First Aid Measures

First Aid:

>> EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

>> SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

>> INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

>> INGESTION: If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

First Aid Measures

Inhalation First Aid

>> Fresh air, rest. Refer immediately for medical attention.

Skin First Aid

>> Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer immediately for medical attention.

Eye First Aid

>> Rinse with plenty of water (remove contact lenses if easily possible). Refer for medical attention.

Ingestion First Aid

>> Rinse mouth. Do NOT induce vomiting. Refer immediately for medical attention.

5. Fire Fighting Measures

>> Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

>> SMALL FIRE: Dry chemical, CO2 or water spray.

>> LARGE FIRE: Water spray, fog or regular foam. If it can be done safely, move undamaged containers away from the area around the fire. Dike runoff from fire control for later disposal. Avoid aiming straight or solid streams directly onto the product.

>> FIRE INVOLVING TANKS, RAIL TANK CARS OR HIGHWAY TANKS: Fight fire from maximum distance or use unmanned master stream devices or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of

tank. ALWAYS stay away from tanks in direct contact with flames. For massive fire, use unmanned master stream devices or monitor nozzles; if this is impossible, withdraw from area and let fire burn. (ERG, 2024)

>> Use water spray, foam, powder, carbon dioxide. In case of fire: keep drums, etc., cool by spraying with water.

6. Accidental Release Measures

Isolation and Evacuation:

Isolation and evacuation measures to take when a large amount of this chemical is accidentally released in an emergency.

>> Excerpt from ERG Guide 152 [Substances - Toxic (Combustible)]:

>> IMMEDIATE PRECAUTIONARY MEASURE: Isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids.

>> SPILL: Increase the immediate precautionary measure distance, in the downwind direction, as necessary.

>> FIRE: If tank, rail tank car or highway tank 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. (ERG, 2024)

Spillage Disposal:

Methods for containment and safety measures to protect workers dealing with a spillage of this chemical.

>> Evacuate danger area! Consult an expert! Personal protection: chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Do NOT wash away into sewer. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Carefully collect remainder. Then store and dispose of according to local regulations.

7. Handling And Storage

Safe Storage:

>> Store only in original container. Keep in a well-ventilated room. Separated from food and feedstuffs. Provision to contain effluent from fire extinguishing. Store in an area without drain or sewer access.

Storage Conditions:

>> Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. ... Store in original container in secured dry storage area. Prevent cross-contamination with other pesticides and fertilizers. Do not store above 1002F for extended periods of time. If container is damaged or spills occurs, use product immediately or dispose of product ... . /Dursban W/

8. Exposure Control/ Personal Protection

REL-TWA (Time Weighted Average)

>> 0.2 mg/m³

>> TWA 0.2 mg/m3 ST 0.6 mg/m3 [skin]

>> none See Appendix G

>> 0.1 [mg/m3], inhalable fraction and vapor

>> 0.1 mg/m

TLV-TWA (Time Weighted Average)

>> 0.1 mg/m³ (inhalable fraction and vapor) [2000]

Inhalation Risk:

>> A harmful concentration of airborne particles can be reached quickly on spraying or when dispersed, especially if powdered.

Effects of Short Term Exposure:

>> The substance may cause effects on the nervous system by a cholinesterase inhibiting effect. Exposure far above the OEL could cause death. The effects may be delayed. Medical observation is indicated.

Effects of Long Term Exposure:

>> Cholinesterase inhibition. Cumulative effects are possible. See Acute Hazards/Symptoms.

Fire Prevention

>> NO open flames.

Exposure Prevention

>> STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN! IN ALL CASES CONSULT A DOCTOR! FIRST AID: USE PERSONAL PROTECTION.

Inhalation Prevention

>> Use local exhaust or breathing protection.

Skin Prevention

>> Protective gloves. Protective clothing.

Eye Prevention

>> Wear face shield or eye protection in combination with breathing protection if powder.

Ingestion Prevention

>> Do not eat, drink, or smoke during work. Wash hands before eating.

Exposure Control and Personal Protection

Exposure Summary

>> Biological Exposure Indices (BEI) [ACGIH] - Acetylcholinesterase activity in red blood cells = 70% of individual's baseline; Butylcholinesterase activity in serum or plasma = 60% of individual's baseline; Sample at end of shift; [TLVs and BEIs]

9. Physical And Chemical Properties

Molecular Weight:

>> 350.6

Exact Mass:

>> 348.926284

Physical Description:

>> Chlorpyrifos is a white crystalline or irregularly flaked solid. It has a very faint mercaptan-type odor. It is not soluble in water. It can cause slight irritation to the eye and skin.

>> COLOURLESS-TO-WHITE CRYSTALS WITH CHARACTERISTIC ODOUR.

Color/Form:

>> White granular crystals

Odor:

>> Mild mercaptan odor

Boiling Point:

>> 320 °F at 760 mmHg (Decomposes) (NIOSH, 2024)

>> No boiling point at normal pressure; decomposes at 160 °C

Melting Point:

>> 108 to 110 °F (NTP, 1992)

>> 41-42 °C

Flash Point:

>> 82 °F (CLOSED CUP) /DURSBAN 4E/

Solubility:

>> approximately 2 mg/L at 77 °F (NTP, 1992)

>> Solubility in water, mg/l at 25 °C: 1.4 (very poor)

Density:

>> 1.4 (Liquid at 110 °F) (NIOSH, 2024) - Denser than water; will sink

>> 1.4 g/cm³

Vapor Density:

>> 12.09 (calculated) (NTP, 1992) - Heavier than air; will sink (Relative to Air)

Vapor Pressure:

>> 1.87e-05 mmHg at 77 °F (NTP, 1992)

>> Vapor pressure, Pa at 25 °C: 0.0024

LogP:

>> log Kow = 4.96

>> 4.96

Stability/Shelf Life:

>> Stable under recommended storage conditions.

Decomposition:

>> Decomposition temperature: approx 160 °C

>> 160 °C. This produces toxic and corrosive fumes including hydrogen chloride, phosgene, phosphorus oxides, nitrogen oxides and sulfur oxides. Attacks copper and brass.

Corrosivity:

The ability of a chemical to damage or destroy other substances when it comes into contact.

>> Corrosive to copper and brass

Dissociation Constants:

>> Practically non-dissociative by nature

Collision Cross Section:

Collision cross section (CCS) represents the effective area for the interaction between an individual ion and the neutral gas through which it is traveling (e.g., in ion mobility spectrometry (IMS) experiments). It quantifies the probability of a collision taking place between two or more particles.

>> 163.12 Å² [M+H]+ [CCS Type: TW; Method: calibrated with polyalanine and drug standards]

>> 168.94 Å² [M+Na]+ [CCS Type: TW; Method: calibrated with polyalanine and drug standards]

10. Stability And Reactivity

>> Insoluble in water. It reacts with water and most reactive hydrogen compounds. The rate of hydrolysis in water increases with pH, with temperature and with the presence of copper and possibly other metals that can form chelates. (NTP, 1992)

11. Toxicological Information

Toxicity Summary:

>> IDENTIFICATION AND USE: Chlorpyrifos (CPF) is a colorless to white crystalline solid with a mild mercaptan odor. CPF is an organophosphate insecticide, acaricide, and miticide used to control foliage and soil-borne insect pests on a variety of food and feed crops. It is 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. HUMAN EXPOSURE AND TOXICITY:

CPF can cause cholinesterase inhibition in humans leading to an overstimulated nervous system causing nausea, dizziness, confusion, and respiratory paralysis and death at very high exposures. Significant changes in plasma cholinesterase inhibition were seen in repeated doses of 0.1 mg/kg of CPF but not in single doses. Organophosphate poisoning may mimic acute complications in pregnancy, such as eclampsia and seizures. Poisoning during pregnancy may result in serious adverse effects for both mother and the fetus or neonate. Prompt diagnosis and treatment including general supportive measures and use of specific pharmacological agents such as atropine and oximes are necessary to avoid adverse outcomes. ANIMAL STUDIES: CPF affects cardiac cholinesterase (ChE) activity and muscarinic receptor binding in neonatal and adult rats. Dose- and time-related changes in body weight and cholinergic signs of toxicity (involuntary movements) were noted in both age groups. With 1x LD(10), relatively similar maximal reductions in ChE activity and muscarinic receptor binding were noted, but receptor binding reductions appeared earlier in adults and were more prolonged in neonates. Studies were performed in dogs to find out whether exposure limits that protect brain acetylcholinesterase (AChE) will protect peripheral tissue AChE after exposure to CPF. The results show that red blood cells AChE is more sensitive than brain or peripheral tissue AChE to inhibition by CPF, and that protection of brain AChE would protect peripheral tissue AChE. Fetal or neonatal exposure to CPF or related organophosphate pesticides leads to abnormalities of brain cell development, synaptic function, and behavior. Studies in rats indicate profound effects on serotonin (5HT) systems that originate during CPF exposure and that are still present at 2 months posttreatment in the young adult. Findings at 5 months of age replicate those seen in young adulthood and strongly suggest that the effects of neonatal CPF exposure on 5HT systems are permanent. Developmental exposure to CPF alters cell signaling both in the brain and in peripheral tissues, affecting the responses to a variety of neurotransmitters and hormones. When tested in adulthood, CPF-exposed male animals displayed elevations in plasma cholesterol and triglycerides, without underlying alterations in nonesterified free fatty acids and glycerol. Similarly, in the postprandial state, male rats showed hyperinsulinemia in the face of normal circulating glucose levels but demonstrated appropriate reduction of circulating insulin concentrations after fasting. Apparently subtoxic neonatal chlorpyrifos exposure, devoid of effects on viability or growth, produce a metabolic pattern for plasma lipids and insulin that resembles the major adult risk factors for atherosclerosis and type 2 diabetes mellitus. CPF was evaluated for clastogenic potential using rat lymphocytes treated for 4 hours with concentrations of up to 5000 mg/mL with and without metabolic activation. No increase in chromosomal aberrations was detected. ECOTOXICITY STUDIES: Intoxication in the bobwhite was characterized by reduced food consumption and diarrhea in 48 hr, followed by lethargy, wing droop, muscular incoordination, tremors and tetany immediately preceding death. There was a significant correlation between ChE activity and total food consumption. A major spillage of the insecticide Dursban (500 L) occurred along the River Roding, Essex, UK on 2 Apr 1985. Within 30 to 40 hr, Dursban had entered tidal reaches of the river, 26 km downstream from the spillage point. 90% of the previous biomass of fish (4740 kg) and all aquatic arthropods were killed over a 23 km stretch of the River Roding. Mollusks and annelids, which are relatively tolerant of chlorpyrifos, survived.

USGS Health-Based Screening Levels for Evaluating Water-Quality:

This section provides the USGS Health-Based Screening Levels for Evaluating Water-Quality data.

Chemical

>> Chlorpyrifos

USGS Parameter Code

>> 65072

Noncancer HBSL (Health-Based Screening Level)[µg/L]

>> 5

Reference

>> Smith, C.D. and Nowell, L.H., 2024. Health-Based Screening Levels for evaluating water-quality data (3rd ed.). DOI:10.5066/F71C1TWP

Evidence for Carcinogenicity:

Evidence that this chemical does or may cause cancer. The information here is collected from various sources by the Hazardous Substances Data Bank (HSDB).

>> Cancer Classification: Group E Evidence of Non-carcinogenicity for Humans

Carcinogen Classification:

This section provides the International Agency for Research on Cancer (IARC) Carcinogenic Classification and related monograph links. In the IARC Carcinogenic classification, chemicals are categorized into four groups: Group 1 (carcinogenic to humans), Group 2A (probably carcinogenic to humans), Group 2B (possibly carcinogenic to humans), and Group 3 (not classifiable as to its carcinogenicity to humans).

>> Spraying and application of nonarsenical insecticides entail exposures that are probably carcinogenic to humans (Group 2A). (L135)

Health Effects:

>> Acute exposure to cholinesterase inhibitors can cause a cholinergic crisis characterized by severe nausea/vomiting, salivation, sweating, bradycardia, hypotension, collapse, and convulsions. Increasing muscle weakness is a possibility and may result in death if respiratory muscles are involved. Accumulation of ACh at motor nerves causes overstimulation of nicotinic expression at the neuromuscular junction. When this occurs symptoms such as muscle weakness, fatigue, muscle cramps, fasciculation, and paralysis can be seen. When there is an accumulation of ACh at autonomic ganglia this causes overstimulation of nicotinic expression in the sympathetic system. Symptoms associated with this are hypertension, and hypoglycemia. Overstimulation of nicotinic acetylcholine receptors in the central nervous system, due to accumulation of ACh, results in anxiety, headache, convulsions, ataxia, depression of respiration and circulation, tremor, general weakness, and potentially coma. When there is expression of muscarinic overstimulation due to excess acetylcholine at muscarinic acetylcholine receptors symptoms of visual disturbances, tightness in chest, wheezing due to bronchoconstriction, increased bronchial secretions, increased salivation, lacrimation, sweating, peristalsis, and urination can occur. Certain reproductive effects in fertility, growth, and development for males and females have been linked specifically to organophosphate pesticide exposure. Most of the research on reproductive effects has been conducted on farmers working with pesticides and insecticdes in rural areas. In females menstrual cycle disturbances, longer pregnancies, spontaneous abortions, stillbirths, and some developmental effects in offspring have been linked to organophosphate pesticide exposure. Prenatal exposure has been linked to impaired fetal growth and development. Neurotoxic effects have also been linked to poisoning with OP pesticides causing four neurotoxic effects in humans: cholinergic syndrome, intermediate syndrome, organophosphate-induced delayed polyneuropathy (OPIDP), and chronic organophosphate-induced neuropsychiatric disorder (COPIND). These syndromes result after acute and chronic exposure to OP pesticides.

Exposure Routes:

>> The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

>> inhalation, skin absorption, ingestion, skin and/or eye contact

Inhalation Exposure

>> Pupillary constriction, muscle cramp, excessive salivation. Muscle twitching. Convulsions. Dizziness. Sweating. Wheezing. Laboured breathing. Unconsciousness.

Skin Exposure

>> MAY BE ABSORBED! See Inhalation.

Eye Exposure

>> Redness. Pain. Pupillary constriction. Blurred vision.

Ingestion Exposure

>> Excessive salivation. Nausea. Vomiting. Abdominal cramps. Diarrhoea. Further see Inhalation.

>> wheezing, laryngeal spasms, salivation; bluish lips, skin; miosis, blurred vision; nausea, vomiting, abdominal cramps, diarrhea

Target Organs:

Organs that are affected by exposure to this chemical. Information in this section reflects human data unless otherwise noted.

>> Neurological (Nervous System)

Adverse Effects:

An adverse effect is an undesired harmful effect resulting from a medical treatment or other intervention.

>> Neurotoxin - Predominantly motor

>> Other Poison - Organophosphate

>> ACGIH Carcinogen - Not Classifiable.

Toxicity Data:

>> LD50: 102 mg/kg (Oral, Rat) (T42) LD50: 1233 mg/kg (Dermal, Rabbit) (T42) LD50: 192 mg/kg (Intraperitoneal, Mouse) (T14) LC50: 560 mg/m3 over 4 hours (Inhalation, Rat) (T42)

Minimum Risk Level:

The minimal risk level (MRL) is an estimate of the amount of a chemical a person can eat, drink, or breathe each day without a detectable risk to health

>> Acute Oral: 0.003 mg/kg/day (L134) Intermediate Oral: 0.003 mg/kg/day (L134) Chronic Oral: 0.001 mg/kg/day (L134)

Treatment:

Treatment when exposed to toxin

>> If the compound has been ingested, rapid gastric lavage should be performed using 5% sodium bicarbonate. For skin contact, the skin should be washed with soap and water. If the compound has entered the eyes, they should be washed with large quantities of isotonic saline or water. In serious cases, atropine and/or pralidoxime should be administered. Anti-cholinergic drugs work to counteract the effects of excess acetylcholine and reactivate AChE. Atropine can be used as an antidote in conjunction with pralidoxime or other pyridinium oximes (such as trimedoxime or obidoxime), though the use of '-oximes' has been found to be of no benefit, or possibly harmful, in at least two meta-analyses. Atropine is a muscarinic antagonist, and thus blocks the action of acetylcholine peripherally.

Interactions:

>> Chlorpyrifos (CPF) is one of the most widely used organophosphorous insecticides in agriculture with its attendant adverse health outcomes. This study aimed at evaluating the effect of subchronic oral CPF administration on hematological and serum biochemical indices, and the possible ameliorating effect of vitamin C on the indices in mice. Thirty mice divided into 3 groups of 10 mice each were used for this study. Mice in group I (control) were dosed with vegetable oil, while those in group II were given CPF (21.3 mg/kg~ 1/5(th) LD50) only. Mice in group III were pretreated with vitamin C (100 mg/kg) prior to dosing with CPF 30 min later (Vitamin C + CPF-treated group). This regime was given to each group of mice three times a week for a period of ten weeks. During the study period, mice were examined for signs of toxicity, and weight of each mouse was measured every week. At the end of the study period, blood samples were collected from the mice and analyzed for packed cell volume (PCV), total red blood cell (RBC), white blood cell (WBC) and total protein (TP). Serum obtained from the blood was analyzed for Na(+, K+ and Cl-), urea, creatinine, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP). The results showed that mice in the vitamin C + CPF-treated group exhibited milder signs of toxicity and significant increase in weight gain ($p<0.01$) compared to the CPF-treated group. No significant increase in weight in the CPF-treated group was observed compared to the control. There was a significant increase in PCV, RBC, Hb, TP and creatinine, but a significant decrease was obtained in WBC, ALT and AST in the CPF-treated group compared to the control. All the parameters with the exception of WBC, ALT and AST (which increased significantly), were significantly decreased in the vitamin C + CPF-treated group compared to CPF-treated group. ALP was significantly elevated in the CPF-treated group compared to both the control and vitamin C + CPF-treated group. No significant changes in urea and the measured electrolytes in all three groups, except a significant decrease in the concentration of Na(+) was observed in the CPF-treated group compared to the control. The study demonstrated that pretreatment of CPF-administered mice with vitamin C significantly altered some important hematological and serum biochemical parameters, revealing the protective action of the vitamin against some organ damage induced by CPF.

Antidote and Emergency Treatment:

>> Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR as necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Organophosphates and related compounds/

Human Toxicity Excerpts:

>> /HUMAN EXPOSURE STUDIES/ ... Five volunteers ingested 1 mg (2852 nmol) of chlorpyrifos. Blood samples were taken over 24 hours and total void volumes of urine were collected over 100 hours. Four weeks later 28.59 mg (81567 nmol) of chlorpyrifos was administered dermally to each volunteer for 8 hours. Unabsorbed chlorpyrifos was washed from the skin and retained for subsequent measurement. The same blood and urine sampling regime was followed as for the oral administration. Plasma and erythrocyte cholinesterase concentrations were determined for each blood sample. The concentration of two urinary metabolites of chlorpyrifos, diethylphosphate and diethyl-thiophosphate was determined for each urine sample. ... The apparent elimination half life of urinary dialkylphosphates after the oral dose was 15.5 hours and after the dermal dose it was 30 hours. Most of the oral dose (mean (range) 93% (55-115%)) and 1% of the applied dermal dose was recovered as urinary metabolites. About half (53%) of the dermal dose was recovered from the skin surface. The absorption rate through the skin, as measured by urinary metabolites was 456 ng/sq cm/hr. Blood plasma and erythrocyte cholinesterase activity did not fall significantly during either dosing regime. ... The amounts of chlorpyrifos used did not depress acetyl cholinesterase activity but could be readily detected as urinary dialkylphosphate metabolites indicating that the urinary assay is a more sensitive indicator of exposure.

Non-Human Toxicity Excerpts:

>> /LABORATORY ANIMALS: Acute Exposure/ ... Organophosphorus (OP) insecticides can potentially influence cardiac function in a receptor-mediated manner indirectly by inhibiting acetylcholinesterase and directly by binding to muscarinic M(2) receptors. Young animals are generally more sensitive than adults to the acute toxicity of OP insecticides and age-related differences in potency of direct binding to muscarinic receptors by some OP toxicants have been reported. ... /The study/ compared the effects of the common OP insecticide chlorpyrifos (CPF) on functional signs of toxicity and cardiac cholinesterase (ChE) activity and muscarinic receptor binding in neonatal and adult rats. Dosages were based on acute lethality (i.e., 0.5 and 1x LD(10): neonates, 7.5 and 15 mg/kg; adults, 68 and 136 mg/kg). Dose- and time-related changes in body weight and cholinergic signs of toxicity (involuntary movements) were noted

in both age groups. With 1x LD(10), relatively similar maximal reductions in ChE activity (95%) and muscarinic receptor binding (approximately 30%) were noted, but receptor binding reductions appeared earlier in adults and were more prolonged in neonates. ... The results suggest that ChE activity (primarily BChE) in neonatal heart may be inherently more sensitive to inhibition by some anticholinesterases and that toxicologically significant binding to muscarinic receptors may be possible with acute chlorpyrifos intoxication, potentially contributing to age-related differences in sensitivity.

Non-Human Toxicity Values:

>> LD50 albino Rats males oral 151 mg/kg /purity 99%/

TSCA Test Submissions:

Under the Toxic Substances Control Act (TSCA), EPA has broad authority to issue regulations designed to require manufacturers (including importers) or processors to test chemical substances and mixtures for health and environmental effects. This section provides information on test reports submitted for this chemical under TSCA.

>> Chlorpyrifos (CAS # 2921-88-2) was evaluated for acute oral toxicity in fasted Fischer 344-derived CDF albino rats (6/sex/group) receiving doses of 250, 500, 1000, and 2000 mg/kg by oral gavage. Like female groups also received the low doses of 63 and 130 mg/kg, while 2 additional groups of males received doses of 630 and 800 mg/kg bodyweight. Mortality associated with treatment occurred from Day 2 to Day 4 post-gavage and, based on the moving average method of Thompson and Weil, was consistent with oral LD50's (with 95% confidence limits) of 774 (687-913) and 235 (164-386) mg/kg bodyweight, respectively, for male and female rats. During 14-day post-gavage observation, all levels of treatment were associated with signs of toxicity including lethargy, rough hair coat, anorexia, diarrhea, excess salivation, watery eyes, labored or rapid shallow breathing, body tremors, and convulsions. All surviving rats gained weight during observation and lacked any treatment-related gross lesions upon necropsy. Accumulated secretions about periocular, perinasal and perioral hair, and fluid fecal-soiled perineum characterized the nonspecific lesions among male and female decedents. Internally, lesions of the gastrointestinal tract were more common among female lethalities, and included decreased ingesta with gaseous distention, peritonitis, and gastric hyperemia with erosions, ulcers and hemorrhage. Isolated cases of thymic atrophy or lobular irregularities of the liver, and thymic hemorrhage were also reported in the male study victims.

Populations at Special Risk:

>> Young persons under 18 yr, expectant or nursing mothers, /alcoholics/, or persons for whom work with toxic chemicals is contraindicated on account of their state of health /are at elevated risk from the toxic effects of organophosphorus pesticides. Those individuals with/ organic diseases of the CNS, mental disorders & epilepsy, pronounced endocrine & vegetative disorders, pulmonary tuberculosis, bronchial asthma, chronic respiratory diseases, cardiovascular diseases and circulatory disorders, gastrointestinal diseases (peptic ulcer), gastroenterocolitis, diseases of the liver & kidneys, eye diseases (chronic conjunctivitis and keratitis) /are at elevated risk from exposure/. /Organophosphorus pesticides/

12. Ecological Information

Resident Soil (mg/kg)

>> 6.30e+01

Industrial Soil (mg/kg)

>> 8.20e+02

Tapwater (ug/L)

>> 8.40e+00

MCL (ug/L)

>> 8.0E+01(G)

Risk-based SSL (mg/kg)

>> 1.20e-01

Chronic Oral Reference Dose (mg/kg-day)

>> 1.00e-03

Volatile

>> Volatile

Mutagen

>> Mutagen

Fraction of Contaminant Absorbed in Gastrointestinal Tract

>> 1

Fraction of Contaminant Absorbed Dermally from Soil

>> 0.1

ICSC Environmental Data:

>> The substance is very toxic to aquatic organisms. This substance may be hazardous to the environment. Special attention should be given to birds and bees. Bioaccumulation of this chemical may occur along the food chain, for example in fish and algae. The substance may cause long-term effects in the aquatic environment. This substance does enter the environment under normal use. Great care, however, should be taken to avoid any additional release, for example through inappropriate disposal.

Sediment/Soil Concentrations:

Concentrations of this compound in sediment/soil.

>> SEDIMENT: Chlorpyrifos was detected at a concentration of 0.007 mg/kg in stream sediment 28 days after application of 0.298 mg/kg to a nearby maize field in Hungary(1). Chlorpyrifos was detected in sediment samples collected from seven sites in the Beijing Guanting reservior in September and November 2003 and June and August 2004 at concentrations ranging from 52.9 to 165 pg/g dry weight, mean 65.9 pg/g dry weight(2). Chlorpyrifos was detected in suspended particulates of the San Joaquin River and its tributaries at less than 0.5 to 153 ng/L and sediment at concentrations of less than 0.5 to 7.2 ng/g(3). Chlorpyrifos was detected in sediment of the Chesapeake Bay at a concentration of 0.0016 ug/kg(4). Chlorpyrifos was detected at mean concentrations of 0-40 ng/g in sediment of Sarasota Bay, FL(5). Sediment samples collected from two southern California watersheds in 2009 (Santa Clara River and Calleguas Creek) contained median chlorpyrifos concentrations of 19 and 2 ng/g(6). Sediment samples collected from 19 depositional areas along the lower Missouri River from Omaha, NE to Jeffersin City, MO in 2002 contained chlorpyrifos levels as high as 6 ng/g(7).

Fish/Seafood Concentrations:

Concentrations of this compound in fish or seafood.

>> In the National Oceanic and Atmospheric Administration's Mussel Watch Project, chlorpyrifos was measured in bivalves collected from 1994 to 1997 from US coastal sites including the Great Lakes(1). Chlorpyrifos concentrations for 244 bivalve collection sites ranged from <0.25 to 52.9 ng/g dry weight, median 0.78 ng/g dry weight, with 27.5% of the sites having concentration means below the estimated average detection limit(1). Chlorpyrifos was detected in 6 samples of Corvina fish species collected from the Salton Sea, California in May 2001 at concentration ranges of <0.18 to 0.6, <0.18 to 3, 0.6 to 2.5, and 0.5 to 2.4 ng/g wet weight in muscle, liver, gonads, and gills samples, respectively(2). Chlorpyrifos was identified, not quantified, from fish in the San Francisco Bay(3). Chlorpyrifos was identified, not quantified, in mussels from the Mediterranean coast(4). Chlorpyrifos was detected in zebra mussels at concentrations of less than 5 ug/kg and eels at concentrations of less than 20 ug/kg from the Rhine and Meuse Rivers, Netherlands(5).

Average Daily Intake:

The average amount of the compound taken into the body through eating, drinking, or breathing.

>> AIR INTAKE: Based on the FDA's Total Diet Study of food composites collected between Oct 1979 and Sept 1980, the FDA has estimated the average daily food intake of chlorpyrifos to be 0.04 ug(1).

13. Disposal Considerations

Spillage Disposal

>> Evacuate danger area! Consult an expert! Personal protection: chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Do NOT wash away into sewer. Sweep spilled substance into covered containers. If appropriate, moisten first to prevent dusting. Carefully collect remainder. Then store and dispose of according to local regulations.

Disposal Methods

>> SRP: The most favorable course of action is to use an alternative chemical product with less inherent propensity for occupational harm/injury/toxicity or environmental contamination. Recycle any unused portion of the material for its approved use or return it to the manufacturer or supplier. Ultimate disposal of the chemical must consider: the material's

impact on air quality; potential migration in soil or water; effects on animal and plant life; and conformance with environmental and public health regulations.

>> SRP: Wastewater from contaminant suppression, cleaning of protective clothing/equipment, or contaminated sites should be contained and evaluated for subject chemical or decomposition product concentrations. Concentrations shall be lower than applicable environmental discharge or disposal criteria. Alternatively, pretreatment and/or discharge to a permitted wastewater treatment facility is acceptable only after review by the governing authority and assurance that "pass through" violations will not occur. Due consideration shall be given to remediation worker exposure (inhalation, dermal and ingestion) as well as fate during treatment, transfer and disposal. If it is not practicable to manage the chemical in this fashion, it must be evaluated in accordance with EPA 40 CFR Part 261, specifically Subpart B, in order to determine the appropriate local, state and federal requirements for disposal.

>> This pesticide is toxic to birds and /other/ wildlife, and extremely toxic to fish and aquatic organisms. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA. /Dursban W/

>> Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Container Disposal: Completely empty liner by shaking or tapping sides and bottom to loosen clinging particles. Empty residues into manufacturing equipment. Then dispose of liner in a sanitary landfill or by incineration, or, if allowed by state and local authorities, by burning. If container is contaminated and cannot be reused, dispose of in the same manner. /Dursban W/

>> For more Disposal Methods (Complete) data for CHLORPYRIFOS (6 total), please visit the HSDB record page.

14. Transport Information

DOT

Chlorpyrifos
6.1
UN Pack Group: III
Reportable Quantity of 1 lb or 0

IATA

Chlorpyrifos
6.1,
UN Pack Group: III

15. Regulatory Information

Federal Drinking Water Guidelines:

Federal drinking water guidelines (e.g. maximum containment level (MCL)) for this chemical. In general, these guidelines are recommendations and not legally enforceable.

>> EPA 2 ug/L

Clean Water Act Requirements:

The Clean Water Act (CWA) of 1972 establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under CWA, the U.S. Environmental Protection Agency (EPA) developed the Toxic Pollutant List (40 CFR Part 401.15) and the Priority Pollutant List (40 CFR Part 423, Appendix A). These lists are to be used by EPA and States to develop the Effluent Guidelines regulations and ensure water quality criteria and standards.

>> Chlorpyrifos is designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance. This designation includes any isomers and hydrates, as well as any solutions and mixtures containing this substance.

Regulatory Information

REACH Registered Substance

>> Status: No longer Valid Update: 05-10-2020 https://echa.europa.eu/registration-dossier/-/registered-dossier/31753

New Zealand EPA Inventory of Chemical Status

>> Chlorpyrifos: HSNO Approval: HSR002942 Approved with controls

16. Other Information

Toxic Combustion Products:

Toxic products (e.g., gases and vapors) produced from the combustion of this chemical.

>> Phosphorous oxides Carbon oxides, nitrogen oxides (NOx), Sulphur oxides, Oxides of phosphorus, Hydrogen chloride gas

Other Safety Information

Chemical Assessment

>> IMAP assessments - Phosphorothioic acid, O,O-diethyl O-(3,5,6-trichloro-2-pyridinyl) ester: Environment tier I assessment

>> IMAP assessments - Phosphorothioic acid, O,O-diethyl O-(3,5,6-trichloro-2-pyridinyl) ester: Human health tier I assessment

"The information provided is believed to be accurate but is not comprehensive and should be used as a reference. It reflects our current knowledge and is intended for safety guidance related to the product. This document does not constitute a warranty of the product's properties. Ionz is not responsible for any damages resulting from handling or contact with the product incorrectly."