UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION,
PESTICIDES, AND TOXIC SUBSTANCES

DATE: July 28, 2006

ACTION MEMORANDUM

SUBJECT: Inert Reassessment—Triethanolamine (CAS Reg. No. 102-71-6)

FROM: Pauline Wagner, Chief Pauline Wagner 7/31/06
Inert Ingredient Assessment Branch
Registration Division (7505P)

TO: Lois A. Rossi, Director
Registration Division (7505P)

I. FQPA REASSESSMENT ACTION

Action: Reassessment of one exemption from the requirement of a tolerance for triethanolamine (TEA). The one tolerance exemption is being reassessed and maintained as-is.

Table 1. Tolerance Exemption Being Reassessed

CFR Citation				CAS Reg. No. and 9CI Name
40 CFR 180	Inert Ingredient	Limits	Uses	
.920[a]	Triethanolamine	(none)	Stabilizer, inhibitor for formulations used before crop emerges from soil	102-71-6 Ethanol, 2,2',2"-nitrilotris-

[a]Residues listed in 40 CFR 180.920 are exempted from the requirement of a tolerance when used in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops only.

Use Summary: TEA is used as stabilizer or inhibitor in pesticide formulations applied before a crop emerges from the soil.

List Reclassification Determination: The current List Classification for TEA is List 2. Because EPA has determined that there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to TEA used as an inert ingredient in pesticide formulations, the List Classification will change from List 2 to List 4B.

II. MANAGEMENT CONCURRENCE

I concur with the reassessment of the exemption from the requirement of a tolerance for the inert ingredient triethanolamine (TEA) (CAS Reg. No. 102-71-6) and with the List Reclassification Determination, as described above. I consider the exemption established in 40 CFR 180.920 to be reassessed for purposes of FFDCA's section 408(q) as of the date of my signature, below. A *Federal Register* Notice regarding this tolerance exemption reassessment decision will be published in the near future.

Lois A. Rossi, Director
Registration Division

Date: July 31, 2006

pc: Debbie Edwards, SRRD
Joe Nevola, SRRD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PREVENTION,
PESTICIDES, AND TOXIC SUBSTANCES

July 28, 2006

MEMORANDUM

SUBJECT: Reassessment of the Exemption from the Requirement of a Tolerance for Triethanolamine (CAS Reg. No. 102-71-6)

FROM: Kathleen Martin and Keri Grinstead
Inert Ingredient Assessment Branch
Registration Division (7505P)

TO: Pauline Wagner, Chief
Inert Ingredient Assessment Branch
Registration Division (7505P)

BACKGROUND

Attached is the science assessment for triethanolamine (TEA). The purpose of this document is to reassess the existing exemption from the requirement of a tolerance for residues of TEA as required under the Food Quality Protection Act (FQPA). This assessment summarizes available information on the use, physical/chemical properties, toxicological effects, exposure profile, environmental fate, and ecotoxicity of TEA.

EXECUTIVE SUMMARY

This document evaluates the exemption from the requirement of a tolerance for triethanolamine (TEA). This substance is exempted from the requirement of a tolerance under 40 CFR 180.920 when used as an inert ingredient (stabilizer or inhibitor) in pesticide formulations applied before the crop emerges from the soil.

In animal studies, TEA has low acute toxicity via the oral and dermal routes, was nonirritating in eye and skin irritation studies, and did not induce skin sensitization. In subchronic and chronic toxicity testing, the main effect was on the liver and kidney, but typically at doses > 500 mg/kg (dermal). Studies have shown that TEA is not carcinogenic, mutagenic, or developmentally toxic. Metabolically, TEA is excreted largely unchanged in the urine and feces within 2 days.

The use restriction of TEA (application before a crop emerges from the soil) effectively limits the timing and number of applications, therefore, significantly reducing the likelihood of residues on food, the potential for residential exposures (dermal and inhalation), and the contribution to drinking water. Therefore, the overall exposure from the use of TEA as an inert ingredient in pesticide products applied before crops emerge from the soil is expected to result in human exposure below any dose level that would produce any adverse effect.

Based on its physical/chemical properties, biodegradation, and use restriction, TEA is not expected to pose a high risk to drinking water, and its potential for bioconcentration in aquatic organisms is low.

According to the Agency's ECOTOX database (US EPA 2006d), TEA is categorized as "practically nontoxic" on an acute basis to freshwater invertebrates, estuarine/marine invertebrates, and freshwater fishes. Additionally, based on the acute toxicity information for the freshwater fishes, TEA may pose potentially similar acute toxicity effects to estuarine/marine fishes. Thus, TEA may be categorized as "practically nontoxic" to estuarine/marine fishes.

Taking into consideration all available information on TEA, the Agency has determined that there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to TEA when used as an inert ingredient in pesticide formulations applied before the crop emerges from the soil, when considering dietary exposure and all other nonoccupational sources of exposure for which there is reliable information. Therefore, it is recommended that the exemption from the requirement of a tolerance for TEA under 40 CFR 180.920 be considered reassessed as safe under section 408(q) of the Federal Food, Drug, and Cosmetic Act.

I. INTRODUCTION

This report provides a qualitative assessment for triethanolamine (TEA), an inert ingredient used as a stabilizer or inhibitor in pesticide formulations applied before a crop emerges from the soil (40 CFR 180.920).

TEA is a widely used industrial chemical. It is used in the cosmetic industry, the manufacture of flame-retardant fabrics, and as a pharmaceutical aid. There are no U.S. Food and Drug Administration (FDA) approved direct food additive uses and it has not been evaluated as a food additive under JEFCA, the Joint World Health Organization (WHO)/Food and Agriculture Organization (FAO) Expert Committee on Food Additives. TEA is not known to be naturally-occurring (IARC 2000).

The use restriction of pesticide formulations containing TEA as an inert ingredient (application before a crop emerges from the soil) effectively limits the timing and number of applications, therefore, significantly reducing the likelihood of residues on food, the potential for residential exposures (dermal and inhalation), and the contribution to drinking water (from runoff).

II. USE INFORMATION

A. PESTICIDE USES

TEA is used as an inert ingredient in pesticide formulations applied before crops emerge from the soil. The exemption from the requirement of a tolerance for TEA is provided in Table 1 below.

Table 1. Tolerance Exemption Being Reassessed in this Document

CFR Citation				CAS Reg. No. and 9CI Name
40 CFR 180	Inert Ingredient	Limits	Uses	
.920[a]	Triethanolamine	(none)	Stabilizer, inhibitor for formulations used before crop emerges from soil	102-71-6 Ethanol, 2,2',2"-nitrilotris-

[a]Residues listed in 40 CFR 180.920 are exempted from the requirement of a tolerance when used in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops only.

B. OTHER USES

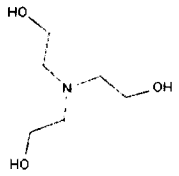
Industrially, TEA is used in the manufacture of surface-active agents (i.e., surfactant), textile specialties, waxes, polishes, herbicides, petroleum demulsifiers, toilet goods, and cement additives; in making emulsions with mineral and vegetable oils, paraffin, and waxes; as a solvent for casein, shellac, and dyes; in the manufacture of synthetic resins; for increasing the penetration of organic liquids into wood and paper; in the production of lubricants for the textile

industry; in the formulations of various cosmetics; and in the preparation of flame-retardant fabrics. TEA USP (U.S. Pharmacopeia) is used as a pharmaceutical adjuvant or alkalizing agent and in combination with a fatty acid (e.g., oleic acid, stearic acid) as an emulsifier (Cavender 2001).

III. PHYSICAL AND CHEMICAL PROPERTIES

Some of the physical and chemical characteristics of TEA, along with its structure and nomenclature, are found in Table 2.

Table 2. Physical and Chemical Properties of Triethanolamine

Parameter	Value	Reference
Structure		ChemIDplus Lite
CAS Reg. No. and 9CI Name	102-71-6 Ethanol, 2,2',2"-nitrilotris-	U.S. EPA Substance Registry System
Empirical Formula	$C_6H_{15}NO_3$	ChemIDplus Lite
Molecular Weight	149.19	ChemIDplus Lite
Common Names	2,2',2"-Nitrilotriethanol; trihydroxytriethylamine; tris (hydroxyethyl) amine;triethylolamine;TEA; nitrilo-2,2',2"-triethanol; tris (hydroxyethyl)amine;T-35; and nitrilotris (ethanol)	Cavender 2001
Physical State	A very hygroscopic, viscous liquid with a light ammoniacal odor. It turns brown on exposure to air and light	Merck 2005
Melting Point	21.57°C	Merck 2005
Boiling Point	335.4°C	Merck 2005
Water Solubility	infinite	Wypych 2000
Other Solubility	Miscible with methanol, acetone	Merck 2005
Relative Density (water=1)	1.1242 @ 20°C	Merck 2005
Relative Vapor Density (air=1)	5.1	Wypych 2000
Vapor Pressure	0.00000359 kPa @ 25°C (2.69×10^{-5} mmHg)	Wypych 2000
Log P_{ow}	-1.59	Wypych 2000
Henry's Law Constant	3.38×10^{-19} atm m^3/mol	Wypych 2000

IV. HAZARD ASSESSMENT

A. HAZARD PROFILE

To assess the hazard posed by the use of TEA as an inert ingredient in pesticide formulations, EPA considered a number of publicly available sources including: published literature, peer-reviewed international documents (e.g., IARC[1], IUCLID[2]) and other standard available references. A valuable source of information was the U.S. Health and Human Services' National Toxicology Program (NTP) which has conducted several studies on TEA including subchronic toxicity, cancer, and mutagenicity.

TEA is not being sponsored by EPA's High Production Volume (HPV) Challenge Program. However, it is being sponsored by the Organization for Economic Cooperation and Development's (OECD) Screening Information Data Set (SIDS) Program;[3] the United Kingdom is the sponsoring country. A SIDS initial assessment profile (SIAP) was prepared in 1997 which indicated that this chemical is of "low priority for further work" (OECD SIDS 1997).

In subchronic and chronic/carcinogenic toxicity testing, the liver and kidney appear to be the target organs.

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[1]In 1969, WHO's International Agency for Research on Cancer (IARC) initiated a program to evaluate the carcinogenic risk of chemicals to humans and to produce monographs on individual chemicals. Each volume serves as an authoritative, independent assessment by international experts of the carcinogenic risk posed by a selected chemical, group of chemicals, industrial process, occupational exposure, lifestyle factor, or biological agent.

[2]IUCLID is a database of existing chemicals that is being compiled by the European Chemicals Bureau (ECB). IUCLID is the basic tool for data collection and evaluation within the EU-Risk Assessment Programme; it has been accepted by the OECD as the data exchange tool under the OECD Existing Chemicals Programme. http://ecb.jrc.it/

[3]The SIDS Program is a voluntary cooperative international testing program that began in 1989. It is focused on developing base level test information on approximately 600 poorly characterized international HPV chemicals. The SIDS data are used to "screen" the chemicals and set priorities for further testing or risk assessment/management activities.
http://cs3-hq.oecd.org/scripts/hpv/

B. TOXICOLOGICAL DATA

Acute Toxicity

A summary of acute toxicity parameters and the corresponding 40 CFR 156.62 Acute Toxicity Categories, are provided in Table 3.

Table 3. Summary of Acute Toxicity Data for Triethanolamine

Parameter		Toxicity Value *Toxicity Category*[a]	Reference
Oral LD_{50}	rats and guinea pigs	8 g/kg *Toxicity Category IV*	Cavender 2001, citing Kindsvatter 1940
	rat	9.11 g/kg *Toxicity Category IV*	Cavender 2001, citing work of Smyth
	mouse	5.2 g/kg bw *Toxicity Category IV*	European Commission 2000, citing Hasegawa et al 1989
	guinea pig	2.2 to 8 g/kg bw *Toxicity Category III*	European Commission 2000, citing Kindsvatter 1940
Dermal LD_{50} rabbit		>2,000 mg/kg bw *Toxicity Category III*	European Commission 2000, citing CIR 1983
Skin Irritation, rabbit		nonirritating	Cavender 2001
Skin Irritation, rat		nonirritating	Cavender 2001
Eye Irritation, rabbit		not irritating[b]	Griffith et al 1980
Skin Sensitization, guinea pig		"a number of guinea pig studies with TEA have failed to induce sensitization"	Knaak, et al 1997

[a]40 CFR 156.62; [b]Draize test using dose volumes of 0.003; 0.01; 0.03; and 0.1 mL.

Inhalation. According to Knaak et al. (1997), "no mortality was reported for rats exposed for 6hr to substantially saturated vapor concentrations of MEA, DEA, or TEA generated at room temperature or to a combination of saturated vapor and mist generated at 170°C. The theoretical saturated vapor concentrations of MEA, DEA, and TEA at room temperature are 520, 0.37, and 0.0047 ppm, respectively. Thus, the LC_{50} of the alkanolamines can be said to be greater than their corresponding vapor concentrations."

Subchronic Toxicity

Inhalation. According to Knaak et al. (1997), Fisher rats were exposed to 0, 125, 250, 500, 100, or 2000 mg/m^3 TEA aerosol for 6 hours/day, 5 days/week, over a period of 16 days. Kidney weights of males and females were elevated at doses ≥ 500mg/m^3; however, these changes generally lacked a dose-response and were not associated with any gross or histopathological change. "It may be concluded that exposure to 250 mg/m^3 failed to produce any treatment-related effects in either sex of exposed rats."

Chronic Toxicity/Carcinogenicity

Oral. Male and female mice were given TEA in their drinking water, *ad libitum*, at doses of: 0; 1% (10,000 ppm) or 2% (20,000 ppm) for 82 weeks. Survival was high at the end of the study; 100% of females and 92% of males survived. There was no significant difference between the body weights of treated and untreated mice. Neoplasms developed in all groups, including the control group, but no dose-related increase in the incidence of any tumor was observed in treated groups of both sexes. There were no adverse effects noted regarding the survival of the mice, organ weights, and specific incidence of neoplasms in the treated group in comparison to the control group (Konishi et al 1992; IARC 2000). No gross or histopathological changes associated with TEA ingestion were observed (Knaak et al. 1997).

Oral. Groups of male and female rats were given TEA in their drinking water, *ad libitum*, at doses of: 0; 1% (10,000 ppm) or 2% (20,000 ppm) for 104 weeks (two years). Doses were approximately 525 and 1100 mg/kg/day in males and initially, approximately 910 and 1970 mg/kg/day in females. Because of nephrotoxicity, the dose levels in females were reduced by half to approximately 455 and 985 mg/kg/day from week 69 to the conclusion of the study. A variety of tumors developed in all groups, including the control group, and all tumors observed were histologically similar to spontaneous tumors in this strain of rats. No statistically-significant increase of the incidence of any tumor was observed in the treated groups of both sexes. However, there was an increase in nephrotoxicity, which appeared to have an adverse effect on the life expectancy of the treated animals, especially of females (Maekawa et al 1986).

Dermal. Groups of 60 male and 60 female rats were topically administered TEA at doses of 32, 64, and 125 mg/kg for males and 63, 125, and 250 mg/kg for females in acetone five days per week for two years. Ten male and ten female rats from each group were evaluated at 15 months for organ weights and histopathology.

At the 15-month interim evaluation, the absolute left and right kidney weights and relative right kidney weight of females administered 250 mg/kg were significantly greater than those of the vehicle controls. "Despite this, no dose-related increase in nontumorigenic histopathological changes was noted in renal tissues of these or any other rats following 15 or 24 mon[ths] of dosing. Chronic nephropathy, typically seen in this strain of rat, was observed to a similar degree in nearly all control and treated animals of both sexes at both time points" (Knaak et al. 1997). A comprehensive evaluation of an increased incidence of renal tubule adenomas in male rats resulted in "an almost identical incidence between control and treatment groups of rats (20%-26%). This suggests a lack of a tumorigenic response in the kidneys in male rats. No treatment-related increase in tumor incidence was noted in any other organ system in male rats or in any treatment groups of female rats. Overall the study failed to generate clear

evidence of a carcinogenic response in rats and that the male kidney tumor data were 'equivocal'" (Knaak et al. 1997).

Mutagenicity

NTP has conducted *in vivo* (micronucleus, Drosophila) and *in vitro* (salmonella, Chinese hamster ovary (CHO) cell cytogenetics) genetic toxicity studies (NTP no date); the data are summarized in Table 4 below. As part of its carcinogenicity review of TEA, IARC (2000) indicated that TEA does not appear to be genotoxic.

Table 4. Summary of Mutagenicity Data for Triethanolamine (NTP no date)

Test		Species	Dose or Concentration	Result	Study ID; Start Date
in vivo	Micronucleus	mice	0 to 4 g/kg	negative	A38253 ; Jan 1993
	Sex-Linked Recessive Lethal	Drosophila	0 to 30,000 ppm	negative	771013
in vitro	Ames Test	*Salmonella typhimurium* TA100; TA1535; TA1537; TA98	10%	negative[a]	683120; 1979
	CHO Cell Cytogenetics: Chromosome Aberrations	CHO cells	10,070 µg/mL	negative[a]	932037 Nov 1981
	CHO Cell Cytogenetics: Sister Chromatid Exchange (SCE)	CHO cells	0 to 1,010 µg/mL	negative (without S9 activation)	932037 1981
			0 to 10,100 µg/mL	negative (with S9 activation)	
			0 to 2,520 µg/mL	questionable (without S9 activation)	

[a]With and without S9 activation.

Developmental and Reproductive Toxicity

TEA was topically administered to groups of 10 male and 10 female rats and mice for 13 weeks at concentrations of: 0, 500, 1000 or 2,000 mg/kg bw/day (rats) and 0, 1000, 2000, or 4000 mg/kg bw/day (mice). Body weight gains were significantly lower in the high-dose rats (2,000 mg/kg), but there was no significant change in the body weights of mice at any dose level. There was no significant change in either sperm motility, morphology, or number; or in the mean duration of the estrous cycle in rats or mice (IARC 2000, citing NTP 1999).

Korhonen et al (1983) injected TEA dissolved in acetone at doses of 0, 1.3, 2.6, 5.2, and 10.5 µmol/ egg into three-day chicken embryos to investigate embryotoxicity. Eleven days after injection the eggs were opened and the embryos inspected for survival and external malformations. Embryotoxic effects

included early mortality and malformations (open coelom[4], short back or neck, edema, and lymph blebs). The incidence of malformations in the TEA-treated groups was not significantly different from that of controls (Korhonen et al 1983; Knaak et al 1997).

Burnett et al (1976) tested the teratogenicity of TEA by topical administration of 2 mL/kg of semipermanent hair dye preparations containing 0.1% to 1.5% TEA (equivalent to about 2 to 30 mg/kg TEA) to the shaved backs of pregnant rats on gestation days 1; 4; 7; 10; 13; 16; and 19. No biologically-significant soft tissue or skeletal changes were noted. The mean numbers of *corpora lutea*, implantation sites, live fetuses, and resorptions per pregnancy, as well as numbers of litters with resorptions, were not significantly affected by the dye treatment. (Burnett et al1976; Knaak et al 1997)

In a Chernoff-Kavlock screening test, 50 female CD-1 mice were administered 1125 mg/kg of TEA by gavage on days 6-15 of gestation. The animals were evaluated for maternal body weight, maternal mortality and signs of toxicity, implantation sites, pup counts at birth with mortality and pup weight (on day 3 postpartum). The NOAEL was reported to be 1125 mg/kg and it was concluded that "oral administration of 1125 mg/kg triethanolamine to pregnant mice did not affect maternal mortality, the number of viable litters, length of gestation, litter size, percent survival of the pups or birth weight or weight gained by the pups" (Pereira, et al., 1987).

C. Metabolism and Pharmacokinetics

TEA appears to be rapidly absorbed in the gastrointestinal tract when ingested. In rodent studies, TEA was eliminated largely unchanged in the urine and feces within two days. Biodegradation to monoethanolamine or diethanolamine (DEA) or to any other recognized metabolite has not been shown in rodents, nor has its incorporation into endogenous macromolecules (IARC 2000).

D. Special Considerations for Infants and Children

TEA has low acute toxicity. Oral and dermal LD_{50} values are at least in Toxicity Category III. An oral Chernoff-Kavlock screening test resulted in a NOAEL of 1125 mg/kg/day in mice. Developmental toxicity studies via the dermal route resulted in no biologically-significant effects in the offspring. In addition, an embryotoxicity study revealed the incidence of malformations in chick embryos treated with TEA was not significantly different from that of controls. No quantitative or qualitative evidence of susceptibility was observed from any of the currently available toxicological data.

[4]Coelom is the cavity in an embryo between the split layers of lateral mesoderm (Taber's 17th edition).

Based on this information, there is no concern, at this time, for increased sensitivity to infants and children to TEA when used as an inert ingredient in pesticide formulations applied before the crop emerges from the soil. For the same reason, a safety factor analysis has not been used to assess risk and, therefore, the additional tenfold safety factor for the protection of infants and children is also unnecessary.

V. ENVIRONMENTAL FATE CHARACTERIZATION AND DRINKING WATER CONSIDERATIONS (NIH 1991, US EPA 2006a, US EPA 2006b)

If released to air, TEA will exist in both the vapor and particulate phases in the ambient atmosphere (this is evidenced by a vapor pressure of 2.69×10^{-5} mmHg at 25°C). Vapor-phase TEA will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 3.5 hours. If released to soil, TEA is expected to have very high mobility based upon an estimated K_{oc} of 7. If released to water, TEA is not expected to adsorb to suspended solids and sediment based upon the estimated K_{oc}. Volatilization from water surfaces and from moist soil surfaces is not expected to be an important fate process based upon this compound's estimated Henry's Law constant of 3.38×10^{-19} atm m^3/mol.

An estimated bioconcentration factor (BCF) of 3 suggests the potential for bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions. Photolysis also is not expected to be important—TEA does not absorb in the environmental ultraviolet (UV) spectrum (>290 nm). In summary, it appears that TEA is susceptible to aerobic aquatic metabolism as proved by various studies in freshwater and saltwater enriched with sewage inoculum. No data are available on the transformation products. It appears that TEA does not pose a high risk to drinking water.

VI. EXPOSURE ASSESSMENT

TEA is used as a stabilizer or inhibitor in pesticide formulations applied to agricultural crops before they emerge from the soil. Individuals may be exposed to TEA through the oral, dermal, and inhalation routes of exposure. The use restriction of TEA (application before a crop emerges from the soil) effectively limits the timing and number of applications (typically one). In soil, TEA is expected to biodegrade fairly rapidly (half-life on the order of days to weeks); therefore, concentrations of concern in drinking water are not expected. Based on this information, dietary (food and drinking water) exposures of concern are not anticipated.

Additional exposure may occur through the dermal and inhalation routes from residential use of pesticide products (e.g., home gardens). The use restriction of TEA effectively limits the number of pesticide applications; therefore, residential exposures of

concern are not expected from the use of TEA as an inert ingredient in pesticide formulations applied before the crop emerges from the soil.

VII. AGGREGATE EXPOSURE

In examining aggregate exposure, the Federal Food, Drug, And Cosmetic Act (FFDCA) section 408 directs EPA to consider available information concerning exposures from the pesticide residue in food and all other nonoccupational exposures, including drinking water from ground water or surface water and exposure through pesticide use in gardens, lawns, or buildings (residential and other indoor uses).

For TEA, a qualitative assessment for all pathways of human exposure (food, drinking water, and residential) is appropriate given the lack of human health concerns associated with exposure to TEA as an inert ingredient in pesticide formulations applied before the crop emerges from the soil.

VIII. CUMULATIVE EXPOSURE

Section 408(b)(2)(D)(v) of the FFDCA requires that, when considering whether to establish, modify, or revoke a tolerance, the Agency consider "available information" concerning the cumulative effects of a particular pesticide's residues and "other substances that have a common mechanism of toxicity."

Unlike other pesticides for which EPA has followed a cumulative risk approach based on a common mechanism of toxicity, EPA has not made a common mechanism of toxicity finding as to TEA and any other substances and, TEA does not appear to produce a toxic metabolite produced by other substances. For the purposes of this tolerance action, therefore, EPA has not assumed that TEA has a common mechanism of toxicity with other substances. For information regarding EPA's efforts to determine which chemicals have a common mechanism of toxicity and to evaluate the cumulative effects of such chemicals, see the policy statements released by EPA's Office of Pesticide Programs concerning common mechanism determinations and procedures for cumulating effects from substances found to have a common mechanism on EPA's website at http://www.epa.gov/pesticides/cumulative/.

IX. HUMAN HEALTH RISK CHARACTERIZATION

In animal studies, TEA has low acute toxicity via the oral and dermal routes, was nonirritating in eye and skin irritation studies, and did not induce skin sensitization. In repeat dosing subchronic and chronic toxicity testing, the main effect was on the liver and kidney but typically at > 500 mg/kg (dermal). Studies have shown that TEA is not carcinogenic, mutagenic, or developmentally toxic. Metabolically, TEA is excreted largely unchanged in the urine and feces within 2 days.

The use restriction of TEA (application before a crop emerges from the soil) effectively limits the timing and number of applications, therefore, significantly reducing

the likelihood of residues on food, the potential for residential exposures (dermal and inhalation), and the contribution to drinking water. Therefore, the overall exposure from the use of TEA as an inert ingredient in pesticide products applied before crops emerge from the soil is expected to result in human exposure below any dose level that would produce any adverse effect.

Taking into consideration all available information on TEA, EPA has determined that there is a reasonable certainty that no harm to any population subgroup will result from aggregate exposure to TEA when used as an inert ingredient in pesticide products applied before the crop emerges from the soil when considering dietary (i.e. food and water) exposure and all other nonoccupational sources of pesticide exposure for which there is reliable information. Therefore, it is recommended that the exemption from the requirement of a tolerance established for residues of TEA under 40 CFR 180.920 be considered reassessed as safe under section 408(q) of FFDCA.

IX. ECOTOXICITY AND ECOLOGICAL RISK CHARACTERIZATION

Freshwater Invertebrates, Acute

According to the Agency's ECOTOX database (US EPA 2006d), TEA is categorized as "practically nontoxic" to freshwater invertebrates based on an EC_{50} value of 1,390,000 µg/L. Table 5 below provides the acute toxicity values that TEA may pose to freshwater invertebrates. (US EPA 2006c)

Table 5. Triethanolamine Acute Toxicity Values to Freshwater Invertebrates

Species	Acute Toxicity Value, EC_{50} (ppb)	Toxicity Category	Ecotox Database Reference Number
Water flea (*Daphnia magna*)	2,150	practically nontoxic	17441

Estuarine/Marine Invertebrates, Acute

According to the Agency's ECOTOX database (US EPA 2006b), TEA is categorized as" practically nontoxic" to estuarine/marine invertebrates based on EC_{50} values ranging from >100,000 to 5,600,000 µg/L. Table 6 below provides the acute toxicity values TEA may pose to estuarine/marine invertebrates.

Table 6. Triethanolamine Acute Toxicity to Estuarine/Marine Invertebrates

Species	Acute Toxicity Value, EC_{50} (ppb)	Toxicity Category	Ecotox Database Reference Number
Common shrimp (*Crangon crangon*)	>100,000	practically nontoxic	11171
Brine Shrimp (*Artema salina*)	5,600,000	practically nontoxic	11171

Freshwater Fish, Acute

According to the Agency's ECOTOX database (US EPA 2006d), TEA is categorized as "practically nontoxic" to freshwater fishes based on EC_{50} values ranging from 17,600 to >10,000,000 µg/L. Table 7 below provides the acute toxicity values that TEA may pose to freshwater fishes. (US EPA 2006c)

Table 7. Triethanolamine Acute Toxicity Values to Freshwater Fish

Species	Acute Toxicity Value, EC_{50} (ppb)	Toxicity Category	Ecotox Database Reference Number
Carp (Leuciscus idus melanotus)	>10,000,000	practically nontoxic	17456
Common carp (*Cyprinus carpio*)	17,600	practically nontoxic	15990
Fathead minnow (*Pimephales promelas*)	1,180,000	practically nontoxic	16992
Goldfish (*Poecilia reticulate*)	5,000,000	practically nontoxic	17221

Estuarine/Marine Fish, Acute

The Agency's ECOTOX database (US EPA 2006d) did not contain any acute toxicity data measuring the effects TEA may potentially pose to estuarine/marine fishes. Based on the acute toxicity effects TEA may pose to freshwater fishes, TEA may pose potentially similar acute toxicity effects to estuarine/marine fishes. Thus, TEA may be categorized as "practically nontoxic" to estuarine/marine fishes.

REFERENCES

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