

21 November 2003

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Appendix A

ROBUST SUMMARY FOR TRIPHENYLBORANE CATEGORY

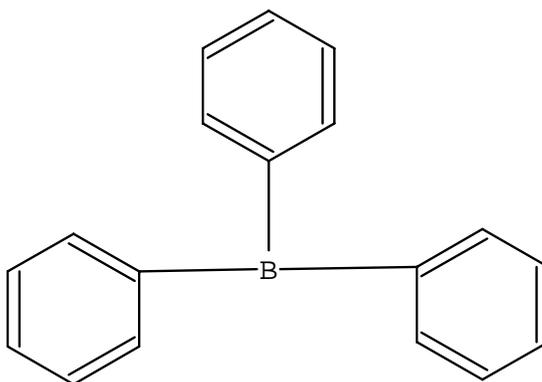
Existing published and unpublished data were collected and scientifically evaluated to determine the best possible study or studies to be summarized for each required endpoint. In the spirit of this voluntary program, other data of equal or lesser quality are not summarized, but are listed as additional references at the end of each appropriate section, with a statement to reflect the reason why these studies were not summarized.

1.0 Substance Information

CAS Number: 960-71-4

Chemical Name: Boron, triphenyl-

Structural Formula:



Other Names: Triphenylborane
Triphenylborine

Exposure Limits: Particulates (not otherwise regulated)
15 mg/m³, 8-hour TWA (total dust)
5 mg/m³, 8-hour TWA (respirable dust): OSHA PEL

2.0 Physical/Chemical Properties

2.1 Melting Point

Value: 136°C
Decomposition: No Data
Sublimation: No Data
Pressure: No Data
Method: No Data
GLP: Unknown
Reference: DuPont Co. (1993). Material Safety Data Sheet DU000148

(September 13).
Reliability: Not assignable because limited study information was available.

Additional References for Melting Point: None Found.

2.2 Boiling Point

Value: 347°C
Decomposition: Decomposes with heat (stable below 380°C)
Pressure: No Data
Method: No Data
GLP: Unknown
Reference: DuPont Co. (1993). Material Safety Data Sheet DU000148 (September 13).
Reliability: Not assignable because limited study information was available.

Additional References for Boiling Point: None Found.

2.3 Density

Value: 1.1 g/cm³
Temperature: No Data
Method: No Data
GLP: Unknown
Results: No additional data.
Reference: Zettler, F. et al. (1974). *J. Organomet. Chem.*, 72(2):157.
Reliability: Not assignable because limited study information was available.

Additional References for Density: None Found.

2.4 Vapor Pressure

Value: 1.19x10⁻⁵ mm Hg
Temperature: 25°C
Decomposition: No data
Method: Modeled; Modified Grain Method. MPBPWIN, v.1.4, module of EPIWIN v.3.11 (Syracuse Research Corporation). MPBPWIN estimates vapor pressure (VP) by three separate methods: (1) the Antoine method, (2) the modified Grain method, and (3) the Mackay method. All three use the normal boiling point to estimate VP.
GLP: Not Applicable
Reference: Lyman, W. J et al. (1990). Handbook of Chemical Property

Estimation Methods, Chapter 14, American Chemical Society, Washington, DC.

Lyman, W. J. (1985). In: Environmental Exposure From Chemicals, Neely, W. B. and G. E. Blau (eds.), Volume I, Chapter 2, CRC Press, Inc., Boca Raton, FL.

Reliability: Estimated value based on accepted model.

Additional References for Vapor Pressure: None Found.

2.5 Partition Coefficient (log Kow)

Value: 5.52
Temperature: 25°C
Method: Modeled. KOWWIN, v.1.67, module of EPIWIN v.311 (Syracuse Research Corporation). KOWWIN uses “fragment constant” methodologies to predict log P. In a “fragment constant” method, a structure is divided into fragments (atom or larger functional groups) and coefficient values of each fragment or group are summed together to yield the log P estimate.
GLP: Not Applicable
Reference: Meylan, W. M. and P. H. Howard (1995). J. Pharm. Sci., 84: 83-92.
Reliability: Estimated value based on accepted model.

Additional References for Partition Coefficient (log Kow): None Found.

2.6 Water Solubility

Value: 9.895×10^{-2} mg/L
Temperature: 25°C
pH/pKa: Estimated pKa: Not Applicable
Method: Modeled.
Solubility - WSKOWWIN v.1.41, module of EPIWIN v3.11 (Syracuse Research Corporation). Water solubility is estimated from log Kow using molecular weight and molecular fragment correction factors.
pKa – SPARC on-line calculator, University of Georgia.
GLP: Not Applicable
Reference: Solubility - Meylan, W. M. et al. (1996). Environ. Toxicol. Chem., 15:100-106.
pKa - <http://ibmlc2.chem.uga.edu/sparc/index.cfm>
Reliability: Estimated value based on accepted model.

Additional Reference for Water Solubility:

DuPont Co. (1993). Material Safety Data Sheet DU000148 (September 13).

2.7 Flash Point: No Data.

2.8 Flammability: No Data

3.0 Environmental Fate

3.1 Photodegradation

Concentration: No Data
Temperature: No Data
Direct Photolysis: Not Applicable
Indirect Photolysis: Estimated half-life due to OH radical oxidation = 65.83 hours. The vapor phase ozone reaction cannot be estimated by the model.
Breakdown Products: No Data
Method: Inspection of chemical structure
GLP: Not Applicable
Reference: AOP Program (v1.91) module of EPIWIN v3.11. Meylan, W. M. and P. H. Howard (1993). Chemosphere, 26:2293-2299.
Reliability: Estimated value based on known qualitative structure-activity relationships.

Additional References for Photodegradation: None Found.

3.2 Stability in Water

Concentration: No Data
Half-life: HYDROWIN, v.1.67 module of EPIWIN v3.11 cannot model this compound. It is reported to hydrolyze moderately rapidly in cold water (Brown and Dodson, 1957) with reported end products of phenylboric oxide, C₆H₅BO and phenylboronic acid, C₆H₅B(OH)₂.
% Hydrolyzed: No Data
Method: Modeled. HYDROWIN, v.1.67 module of EPIWIN v3.11 (Syracuse Research Corporation). HYDROWIN estimates aqueous hydrolysis rate constants for the following chemical classes: esters, carbamates, epoxides, halomethanes and selected alkyl halides. HYDROWIN estimates acid- and base-catalyzed rate constants; it does NOT estimate neutral hydrolysis rate constants. The prediction methodology was developed for the U.S. Environmental Protection Agency

and is outlined in Mill, T. et al., 1987.
GLP: Not Applicable
Reference: Brown, H. C. and V. H. Dodson (1957). J Amer. Chem. Soc., 79: 2303.

Mill, T., et al. (1987). "Environmental Fate and Exposure Studies Development of a PC-SAR for Hydrolysis: Esters, Alkyl Halides and Epoxides," EPA Contract No. 68-02-4254, SRI International, Menlo Park, CA.
Reliability: Estimated value based on an accepted model.

Additional References for Stability in Water: None Found.

3.3 Transport (Fugacity)

Media: Air, Water, Soil, and Sediments
Distributions:

Compartment	% of total distribution	½ life (hours)
Air	0.94	65.8
Water	6.74	900
Soil	47.6	1800
Sediment	44.8	8100

Adsorption Coefficient: $K_{oc} = 1.36 \times 10^5$ (calc by model)
Desorption: No Data
Volatility: Henry's Law Constant = 3.83×10^{-5} atm-m³/mole
Method: Environmental Distribution - Mackay Level III fugacity model, in EPIWIN v3.11 (Syracuse Research Corporation). Emissions (1000 kg/hr) to air, water, and soil compartments using EPA Model defaults.

Data Used:
Henry's Law Constant: 3.83×10^{-5} atm-m³/mole (calculated; VP/Wsol)
Vapor Pressure: 1.19×10^{-5} mm Hg (MPBPWIN program)
Liquid Vapor Pressure: 1.49×10^{-4} mm Hg (super-cooled)
Melting Point: 136°C (user-entered)
Log Kow: 5.52 (KOWWIN program)
Soil Koc: 1.36×10^5 (calculated by model)

Henry's Law Constant - HENRYWIN v. 3.10 module of EPIWIN v3.11 (Syracuse Research Corporation). Henry's Law Constant (HLC) is estimated by two separate methods that yield two separate estimates. The first method is the bond contribution method and the second is the group contribution method. The bond contribution method is able to estimate many more types of structures; however, the

group method estimate is usually preferred (but not always) when all fragment values are available.

Koc – Calculated from log Kow by the Mackay Level III fugacity model incorporated into EPIWIN v3.11 (Syracuse Research Corporation).

GLP: Not Applicable

Reference: HENRYWIN –

Hine, J. and P. K. Mookerjee (1975). J. Org. Chem., 40(3):292-298.

Meylan, W. and P. H. Howard (1991). Environ. Toxicol. Chem., 10:1283-1293.

Fugacity - The methodology and programming for the Level III fugacity model incorporated into EPIWIN v3.11 (Syracuse Research Corporation) were developed by Dr. Donald MacKay and coworkers and are detailed in:

Mackay, D. (1991). Multimedia Environmental Models: The Fugacity Approach, pp. 67-183, Lewis Publishers, CRC Press.

Mackay, D. et al. (1996). Environ. Toxicol. Chem., 15(9):1618-1626.

Mackay, D. et al. (1996). Environ. Toxicol. Chem., 15(9):1627-1637.

Reliability: Estimated values based on accepted models.

Additional References for Transport (Fugacity): None Found.

3.4 Biodegradation

Value:	Timeframe:
Linear Model Prediction:	Biodegrades Fast, 1.0165
Non-Linear Model Prediction:	Biodegrades Fast, 0.9931
Ultimate Biodegradation Timeframe:	Weeks-Months, 2.7301

Primary Biodegradation Timeframe: Days-Weeks, 3.5131

MITI Linear Model Prediction: Does Not Biodegrade Fast, 0.1151

MITI Non-Linear Model Prediction: Does Not Biodegrade Fast, 0.0652

Breakdown Products: No Data

Method: Modeled. BIOWIN, v. 4.01 module of EPINWIN v3.11 (Syracuse Research Corporation). BIOWIN estimates the probability for the rapid aerobic biodegradation of an organic chemical in the presence of mixed populations of environmental microorganisms. Estimates are based upon fragment constants that were developed using multiple linear and non-linear regression analyses.

GLP: Not Applicable

Reference: Boethling, R. S. et al. (1994). Environ. Sci. Technol., 28:459-65.

Howard, P. H. et al. (1992). Environ. Toxicol. Chem., 11:593-603.

Howard, P. H. et al. (1987). Environ. Toxicol. Chem., 6:1-10.

Tunkel, J. et al. (2000). Predicting Ready Biodegradability in the MITI Test. Environ. Toxicol. Chem., accepted for publication.

Reliability: Estimated value based on accepted model.

Additional References for Biodegradation: None Found.

3.5 Bioconcentration

Value: BCF = 3558 (Estimated Log BCF = 3.551)

Method: Modeled. BCFWIN v.2.15 module of EPINWIN v3.11 (Syracuse Research Corporation). BCFWIN estimates the bioconcentration factor (BCF) of an organic compound using the compound's log octanol-water partition coefficient (Kow) with correction factors based on molecular fragments.

GLP: Not Applicable

Reference: "Improved Method for Estimating Bioconcentration Factor

(BCF) from Octanol-Water Partition Coefficient,” SRC TR-97-006 (2nd Update), July 22, 1997; prepared for Robert S. Boethling, EPA-OPPT, Washington, DC, Contract No. 68-D5-0012; prepared by William M. Meylan, Philip H. Howard, Dallas Aronson, Heather Printup and Sybil Gouchie, Syracuse Research Corp.

Reliability: Estimated value based on accepted model.

Additional References for Bioconcentration: None Found.

4.0 Ecotoxicity

4.1 Acute Toxicity to Fish: No Data.

4.2 Acute Toxicity to Invertebrates

Type: 48-hour EC₅₀
Species: *Daphnia magna*
Value: 0.002 mg/L
Method: The test was conducted in a static system over 48 hours according to OECD Guideline 202. Nominal concentrations tested were 0, 0.00001, 0.0001, 0.001, 0.1, and 1 mg/L.
GLP: Unknown
Test Substance: Triphenylborane, purity not reported
Results: No additional data.
Reference: BASF Corporation (2003). 8EHQ-0203-15271, Letter from BASF to 8(e) Coordinator, EPA dated January 27, 2003.
Reliability: Medium because a suboptimal study design (nominal test concentrations) was used.

Additional References for Acute Toxicity to Invertebrates: None Found.

4.3 Acute Toxicity to Aquatic Plants: No Data.

5.0 Mammalian Toxicity

5.1 Acute Toxicity

Type: Oral LD₅₀
Species/Strain: Male rats/ChR-CD
Value: 196 mg/kg (95% confidence limits, 175-217 mg/kg)
Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

The test substance, as a suspension in corn oil, was administered by intragastric intubation in single doses of

150, 180, 225, and 250 mg/kg to 4 groups of young adult male rats (10 animals per group). Clinical signs and body weights were recorded. Survivors were sacrificed 14 days later without pathological examination. The LD₅₀ value was calculated from mortality data, using the method of D. J. Finney.

GLP: No
 Test Substance: Triphenylborane, purity >90%
 Results: Mortality was 0/10, 5/10, 8/10 and 8/10 at 150, 180, 225, and 250 mg/kg, respectively. All mortality occurred 1-3 days after dosing. Weight loss occurred 1-3 days after dosing at 150, 180, and 250 mg/kg. Weight loss occurred 1-4 days after dosing at 225 mg/kg. Test days that clinical signs were observed are included in the table below.

Dose (mg/kg):	150	180	225	250
Clinical Sign:				
Alopecia	3	- ^a	-	-
Belly to cage posture	-	-	3	-
Chromodacryorrhea	2	1	3	1-2
Congestion	-	4	-	1-2
Diarrhea	3,5-6	-	1	-
Humped posture	-	-	-	3-4
Lacrimation	-	1	-	-
Shovel nosing	-	-	-	0
Stained body	-	3-4	-	3-4
Stained face/mouth/nose	2-3	1-2	2,4	1
Stained perineal area	2	4	3,5	1
Stained underside	-	-	4	-
Wet face	3	-	-	-

^a Clinical sign was not observed in any rat at this dose level.

Reference: DuPont Co. (1978). Unpublished Data, Haskell Laboratory Report No. 492-78, "Oral LD₅₀ Test" (August 25).

Reliability: High because a scientifically defensible or guideline method was used.

Type: Oral ALD
Species/Strain: Male rats/
Value: 2250 mg/kg
Method: The test material, as a suspension in corn oil, was administered by intragastric intubation to young adult ChR-CD male rats (1/dose level) in single doses of 450, 670,

1000, 1500, 2250, 5000, 7500, or 11,000 mg/kg. Survivors were sacrificed 14 days later without pathologic examination.

GLP: No
Test Substance: Triphenylborane, purity 10% active ingredient
Results: Mortality occurred within 2 days at ≥ 2250 mg/kg. Clinical signs observed in lethal doses included diarrhea, tremors, weakness, lethargy, and weight loss. Clinical signs at non-lethal doses included stained perineal area, ruffled fur, pallor, lethargy during the first 4 days after dosing at 1500 mg/kg; and weight loss for 3 and 2 days at 1500 and 1000 mg/kg, respectively.
Reference: DuPont Co. (1972). Unpublished Data, Haskell Laboratory Report No. 417-72, "Acute Oral Test" (October 23).
Reliability: High because a scientifically defensible or guideline method was used.

Additional Reference for Acute Oral Toxicity: None Found.

Type: **Inhalation ALC**
Species/Strain: Male rats/ChR-CD
Exposure Time: 4 hours
Value: 0.073 mg/L
Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

A cyclone-type dust generator was used to produce the test atmosphere in a 30-liter exposure chamber. The concentrations of the airborne particulate in the chamber were determined by periodically drawing test atmosphere volumes through glass fiber filters. Particulate trapped on the fibers was weighed. A Brinks cascade impactor was used to determine the mass median diameter of particles generated.

Six male ChR-CD rats (231-292 grams initial body weight) were exposed head-only to 0.004, 0.050, 0.073, and 0.474 mg/L of the test substance. Following exposure, the rats were placed in a recovery area and weighed and observed daily (except weekends) for 14 days or until death. No pathological examinations were conducted. The mortality data were used as the basis for determining the approximate lethal concentration (ALC).

GLP: No
Test Substance: Triphenylborane, purity 100%

Results: The average mass median diameter of particles generated during the exposures was approximately 2.06 μ . Due to mechanical difficulties, this average does not include particle size analysis from the 0.050 mg/L exposure. Mass median diameter was 3.2, 1.2, and 1.8 μ at 0.004, 0.073, and 0.474 mg/L, respectively.

Mortality was 0/6, 0/6, 1/6, and 4/6 at 0.004, 0.050, 0.073, and 0.474 mg/L, respectively.

Clinical signs at 0.004 mg/L included sporadic chewing motion, and red discharge from the nose and eyes during exposure. During recovery, body weight loss within 24 to 48 hours was observed, with recovery thereafter.

Clinical observations at 0.050 mg/L included chewing motion, red discharge from the nose and eyes, and very mild lethargy during exposure. During recovery, body weight loss was followed by normal weight gain within 48 hours, and sporadic cases of red discharge from the eyes were observed.

Clinical observations at 0.073 mg/L included 1 of 6 rats gasping, all had red discharge from the nose and eyes, blinking, chewing motion, and sporadic salivation during exposure. During recovery, 1 of 6 rats showed fluctuating weight with a final body weight of approximately 64% of initial body weight. This rat was found dead on the morning of day 14 of recovery. All other rats showed weight loss within 48 hours of exposure with normal weight gain thereafter. There were sporadic cases of eye and nasal discharge and irregular respiration.

Clinical signs at 0.474 mg/L included 1 of 6 rats with sporadic facial tremors, all rats with red discharge from nose and eyes, blinking, chewing motion, and sporadic salivation during exposure. During recovery, all rats showed gasping and red discharge from the nose and eyes. Prostration and corneal opacity were sporadic. All rats showed weight loss to time of death. The 2 rats that survived the recovery period showed weight loss to approximately day 12 of recovery, with weight gain thereafter. One of 6 rats died within 24 hours of exposure, two of six died within 48 hours of exposure, and 1 of 6 rats died within 96 hours of exposure.

Reference: DuPont Co. (1978). Unpublished Data, Haskell Laboratory Report No. 627-78, "Approximate Lethal Concentration –

Inhalation Exposure (4 Hours)” (November 10) (also cited in TSCA Fiche OTS0540607).

Reliability: High because a scientifically defensible or guideline method was used.

Additional References for Acute Inhalation Toxicity: None Found.

Type: **Dermal Toxicity:** No Data

Type: **Dermal Irritation**
Species/Strain: Rabbits/Albino
Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

Six albino rabbits weighing 2-3 kg were clipped free of hair on the back and placed in FDA-type stocks. One-half gram of the test substance (as supplied) was applied under cotton gauze pads, and the trunk of each rabbit was then loosely wrapped with rubber sheeting. After 4 hours, the rabbits were removed from the stocks, the wrapping and gauze pads were removed, and any skin reactions were evaluated. The test sites were then washed. Readings were again made at 24 and 48 hours after the initial application.

GLP: No
Test Substance: Triphenylborane, purity 100%
Results: The test substance produced skin corrosion in 6 of 6 rabbits. When tested and classified according to the regulation of the Department of Transportation (Hazardous Materials Regulations, Title 49 CFR, Section 173.240(a) (1), October 1, 1975), the test substance was corrosive to the rabbit skin.
Reference: DuPont Co. (1977). Unpublished Data, Haskell Laboratory Report No. 995-76, “Department of Transportation Skin Corrosion Test on Rabbit Skin” (January 14).
Reliability: High because a scientifically defensible or guideline method was used.

Additional Reference for Dermal Irritation:

This study was not chosen for detailed summarization for this endpoint because the focus of the study was dermal sensitization. However, irritation reported can be found listed in the summary for Dermal Sensitization.

DuPont Co. (1977). Unpublished Data, Haskell Laboratory Report No. 192-77, “Primary Skin Irritation and Sensitization Tests on Guinea Pigs” (April 1).

Type:	Dermal Sensitization
Species/Strain:	Male guinea pigs/Albino
Method:	No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.
	<p>The test for primary irritation was conducted by applying, and lightly rubbing in, 1 drop (approximately 0.05 mL) each at a 10% and 1% slurry of the test material on the shaved intact shoulder skin of 10 male albino guinea pigs (initial average weight 494 g). To test for the sensitization potential, a series of 4 sacral intradermal injections was given, 1 each week over a 3-week period, which consisted of 0.1 mL of a 1% slurry of the test substance. Following a 2-week rest period, the test animals were challenged for sensitization by applying, and lightly rubbed in, 1 drop (approximately 0.05 mL) each of a 10% and a 1% slurry of the test substance on the shaved intact shoulder skin. A group of 10 previously unexposed guinea pigs (average weight 733 g) received similar applications at the time of challenge to provide a direct comparison of the challenge reactions on skin of similar age. Sensitization was defined as a significant score increase at challenge over the response expected from the same amount applied initially or on the concurrent control.</p>
GLP:	No
Test Substance:	Triphenylborane, purity not reported
Results:	The test substance produced mild irritation when tested as a 10% slurry on the shaved intact skin of male albino guinea pigs. No irritation was observed at the 1% concentration. No sensitization was observed at challenge.
Reference:	DuPont (1977). Unpublished Data, Haskell Laboratory Report No.192-77, "Primary Skin Irritation and Sensitization Tests on Guinea Pigs" (April 1).
Reliability:	High because a scientifically defensible or guideline method was used.

Additional References for Dermal Sensitization: None Found.

Type:	Eye Irritation
Species/Strain:	Rabbits/Albino
Method:	No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

One-tenth milliliter (30 mg) of the dry powder was placed into the right conjunctival sac of each of 2 albino rabbits. In a 2nd test, 0.1 mL of a freshly prepared 20% solution of the test substance in 3-pentenenitrile was placed into the right conjunctival sac of each of 2 other rabbits. After 20 seconds, 1 treated eye was washed with tap water for 1 minute. The treated eye of the other rabbit was not washed. Observations of the cornea, iris, and conjunctiva were made with a hand-slit lamp at 1 and 4 hours, and at 1, 2, 3, 7, or 14 days. Fluor-i-strip[®] stain and a biomicroscope were used at examinations after the day of treatment.

GLP: No
Test Substance: Triphenylborane, purity 100%
Results: The test substance, dry powder and as a 20% solution in 3-pentenenitrile, severely irritated rabbit eyes. Corneal effects were severe to moderate and irreversible. Iritic effects were moderate to severe and probably reversible in 3 of the 4 treated eyes, but 1 eye had debris in the anterior chamber and on the lens, and the pupil was not round by 7 days. Conjunctival irritation was severe and lingering. None of the treated eyes were normal by 14 days. The test substance was a severe eye irritant.
Reference: DuPont Co. (1976). Unpublished Data, Haskell Laboratory Report No. 994-76, "Eye Irritation Test in Rabbits" (January 14) (also cited in TSCA Fiche [OTS0571505](#)).
Reliability: High because a scientifically defensible or guideline method was used.

Additional References for Eye Irritation: None Found.

5.2 Repeated Dose Toxicity: No Data.

5.3 Developmental Toxicity: No Data.

5.4 Reproductive Toxicity: No Data.

5.5 Genetic Toxicity

Type: *In vitro* Bacterial Reverse Mutation Assay
Tester Strain: *Salmonella typhimurium* TA1535, TA100, TA1537, TA1538, TA98
Exogenous Metabolic Activation: Rat liver homogenate activation system (S9)
Exposure Concentrations: 0, 0.8, 1.6, 2.4, 3.2, 4.0 µg/plate

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Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

The tests were performed as a single trial in the presence and absence of a rat liver homogenate activation system (S9). In the absence of metabolic activation, a solution of the test substance and approximately 10^8 bacteria were added to top agar. The solution was mixed and poured on the surface of a Davis minimal agar plate. The metabolic activation system involved the addition of S9 mixture to the chemical-top agar solution. The S9 mix contained 9000 x g supernatant of homogenized rat liver, $MgCl_2$, KCl, glucose-6-phosphate, NADP, and sodium phosphate (pH 7.4). This mixture was added directly to the top agar immediately before it was poured over the minimal agar plate. Prior to testing for mutagenicity, the test substance was tested for toxicity to the tester strains. The solvent control was distilled water and the positive control was 2-aminoanthracene. All plates were incubated at 37°C for 48 hours.

GLP: No

Test Substance: Triphenylborane, purity not reported

Results: Negative

Remarks: The test substance was not mutagenic in the microbial assay either in the presence or absence of a liver microsomal system (i.e., it did not induce a significant increase over the spontaneous mutation frequency). Due to the extreme toxicity of the test substance to the tester strains, the mutagenicity test could be conducted only over a limited dose range.

Reference: DuPont Co. (1977). Unpublished Data, Haskell Laboratory Report No. 224-77, "Mutagenic Activity in the *Salmonella*/Microsome Assay" (April 18).

Reliability: High because a scientifically defensible or guideline method was used.

Additional References for *In vitro* Bacterial Reverse Mutation Assay: None Found.

Type: *In vitro* Clastogenicity Studies: No Data.

Type: *In vivo* Genetic Toxicity: No Data.

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Appendix B

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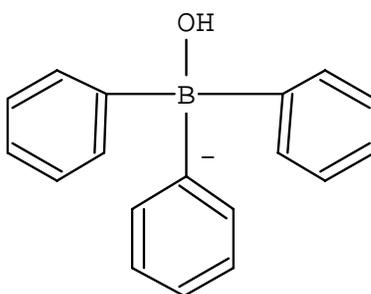
Existing published and unpublished data were collected and scientifically evaluated to determine the best possible study or studies to be summarized for each required endpoint. In the spirit of this voluntary program, other data of equal or lesser quality are not summarized, but are listed as additional references at the end of each appropriate section, with a statement to reflect the reason why these studies were not summarized.

1.0 Substance Information

CAS Number: 12113-07-4

Chemical Name: Borate (1-), hydroxytriphenyl-, sodium, (T-4)

Structural Formula:



Na

Other Names: Sodium hydroxide, compd. with Ph₃B
Sodium hydroxytriphenylborate
TPB/Sodium hydroxide adduct
Triphenylborane/sodium hydroxide adduct
Sodium hydroxide adduct
Borane, triphenyl/Sodium hydroxide

Exposure Limits: No Data

2.0 Physical/Chemical Properties

2.1 Melting Point

Value:	>300°C
Decomposition:	Decomposes
Sublimation:	No Data
Pressure:	760 mm Hg
Method:	No Data
GLP:	Not Applicable
Reference:	DuPont Co. (1977). Unpublished Data, "Second Generation

Reliability: ADN Manufacturing Basic Data Report” (January 28).
Not assignable because limited study information was available.

Additional Reference for Melting Point:

Birnbaum, H. H. and H. L. Anderson, US 3268401 (10/23/66), assigned to 3M.

2.2 Boiling Point

Value: 644.67°C
Decomposition: No Data
Pressure: 760 mm Hg
Method: Modeled. MPBPWIN, v. 1.41 module of EPIWIN 3.11 (Syracuse Research Corporation). MPBPWIN estimates the normal boiling point using an adaptation of the Stein and Brown (1994) method, which is an extension, and refinement of the Joback method (Joback, 1982; Reid et al., 1987).
GLP: Not Applicable
Reference: Stein, S. E. and R. L. Brown (1994). J. Chem. Inf. Comput. Sci., 34:581-587.

Joback, K. G. (1982). A Unified Approach to Physical Property Estimation Using Multivariate Statistical Techniques. Stevens Institute of Technology, submitted to the Dept. of Chem. Eng. for M.S. Degree at the Massachusetts Institute of Technology in June 1984 (see also: Reid et al., 1987).

Reliability: Reid, R. C. et al. (1987). The Properties of Gases and Liquids, Fourth edition, Chapter 2, McGraw-Hill, Inc., NY.
Estimated value based on an accepted model.

Additional References for Boiling Point: None Found.

2.3 Density

Value: 1.35 g/cm³
Temperature: No Data
Method: No Data
GLP: Unknown
Results: No additional data.
Reference: DuPont Co. (1977). Unpublished Data, “Second Generation ADN Manufacturing Basic Data Report” (January 28).
Reliability: Not assignable because limited study information was

available.

Additional References for Density: None Found.

2.4 Vapor Pressure

Value: 8.52×10^{-18} mm Hg
Temperature: 25°C
Decomposition: No Data
Method: Modeled; Modified Grain Method. MPBPWIN, v. 1.41, module of EPIWIN 3.11 (Syracuse Research Corporation). MPBPWIN estimates vapor pressure (VP) by three separate methods: (1) the Antoine method, (2) the modified Grain method, and (3) the Mackay method. All three use the normal boiling point to estimate VP.
GLP: Not Applicable
Reference: Lyman, W. J. et al. (1990). Handbook of Chemical Property Estimation Methods, Chapter 14, American Chemical Society, Washington, DC.

Lyman, W. J. (1985). In: Environmental Exposure From Chemicals, Volume I, Chapter 2, Neely, W. B. and G. E. Blau (eds.), CRC Press, Inc., Boca Raton, FL.
Reliability: Estimated value based on an accepted model.

Additional References for Vapor Pressure: None Found.

2.5 Partition Coefficient (log K_{ow})

Value: 4.37
Temperature: 25°C
Method: Modeled. KOWWIN, v. 1.67, module of EPIWIN 3.11 (Syracuse Research Corporation). KOWWIN uses “fragment constant” methodologies to predict log P. In a “fragment constant” method, a structure is divided into fragments (atom or larger functional groups) and coefficient values of each fragment or group are summed together to yield the log P estimate.
GLP: Not Applicable
Reference: Meylan, W. M. and P. H. Howard (1995). J. Pharm. Sci., 84: 83-92.
Reliability: Estimated value based on an accepted model.

Additional References for Partition Coefficient (log K_{ow}): None Found.

2.6 Water Solubility

Value: 2.882 mg/L
Temperature: 25°C
pH/pKa: Estimated pKa: Not Applicable
Method: Modeled.
Solubility - WSKOWWIN v.1.41, module of EPIWIN v3.11 (Syracuse Research Corporation). Water solubility is estimated from log Kow using molecular weight and molecular fragment correction factors.
pKa – SPARC on-line calculator, University of Georgia.
GLP: Not Applicable
Reference: Solubility - Meylan, W. M. et al. (1996). Environ. Toxicol. Chem., 15:100-106.
pKa - <http://ibmlc2.chem.uga.edu/sparc/index.cfm>
Reliability: Estimated value based on accepted models.

Additional References for Water Solubility: None Found.

2.7 Flash Point: No Data.

2.8 Flammability: No Data.

3.0 Environmental Fate

3.1 Photodegradation

Concentration: No Data
Temperature: No Data
Direct Photolysis: No Data
Indirect Photolysis: Estimated half-life due to OH radical oxidation = 64.29 hours. The vapor phase ozone reaction cannot be estimated by the model.
Breakdown Products: No Data
Method: Inspection of chemical structure
GLP: Not Applicable
Reference: AOP Program (v1.90) module of EPIWIN v3.11. Meylan, W. M. and P. H. Howard (1993). Chemosphere, 26:2293-2299.
Reliability: Estimated value based on known qualitative structure-activity relationships.

Additional References for Photodegradation: None Found.

3.2 Stability in Water

Concentration: No Data
Half-life: No Data
% Hydrolyzed: No Data
Method: Modeled. HYDROWIN, v. 1.67 module of EPIWIN v3.11 (Syracuse Research Corporation). HYDROWIN estimates aqueous hydrolysis rate constants for the following chemical classes: esters, carbamates, epoxides, halomethanes and selected alkyl halides. HYDROWIN estimates acid- and base-catalyzed rate constants; it does NOT estimate neutral hydrolysis rate constants. The prediction methodology was developed for the U.S. Environmental Protection Agency and is outlined in Mill et al., 1987.

GLP: Not Applicable
Reference: Mill, T. et al. (1987). "Environmental Fate and Exposure Studies Development of a PC-SAR for Hydrolysis: Esters, Alkyl Halides and Epoxides," EPA Contract No. 68-02-4254, SRI International, Menlo Park, CA.

Harris, J. C. (1990). Rate of Hydrolysis. Chapter 7 In: Handbook of Chemical Property Estimation Methods, Lyman, W. J. et al. (eds.), American Chemical Society, Washington, DC.

Reliability: Estimated value based on an accepted model.

Additional References for Stability in Water: None Found.

3.3 Transport (Fugacity)

Media: Air, Water, Soil, and Sediments

Distributions:	Compartment	% of total distribution	½ life (hours)
	Air	0.0024	64.3
	Water	10.3	900
	Soil	83.9	1800
	Sediment	5.75	8100

Adsorption Coefficient: $K_{oc} = 9.61 \times 10^3$ (calc by model)
Desorption: No Data
Volatility: Henry's Law Constant = 1.1×10^{-18} atm-m³/mole
Method: Environmental Distribution - Mackay Level III fugacity model, in EPIWIN v3.11 (Syracuse Research Corporation). Emissions (1000 kg/hr) to air, water, and soil compartments.

Data Used:

Henry's Law Constant: 1.1×10^{-18} atm-m³/mole (calculated; VP/Wsol)

Vapor Pressure: 8.52×10^{-18} mm Hg (MPBPWIN program)

Liquid Vapor Pressure: 2.85×10^{-15} mm Hg (super-cooled)

Melting Point: 280°C (MPBPWIN program)

Log Kow: 4.37 (KOWWIN program)

Soil Koc: 9.61×10^3 (calculated by model)

Henry's Law Constant - HENRYWIN v. 3.10 module of EPIWIN v3.11 (Syracuse Research Corporation). Henry's Law Constant (HLC) is estimated by two separate methods that yield two separate estimates. The first method is the bond contribution method and the second is the group contribution method. The bond contribution method is able to estimate many more types of structures; however, the group method estimate is usually preferred (but not always) when all fragment values are available.

Koc – Calculated from log Kow by the Mackay Level III fugacity model incorporated into EPIWIN v3.11 (Syracuse Research Corporation).

GLP:

Not Applicable

Reference:

HENRYWIN –

J. Hine and P. K. Mookerjee (1975). J. Org. Chem., 40(3):292-298.

Meylan, W. and P. H. Howard (1991). Environ. Toxicol. Chem., 10:1283-1293.

Fugacity - The methodology and programming for the Level III fugacity model incorporated into EPIWIN v3.11 (Syracuse Research Corporation) were developed by Dr. Donald MacKay and coworkers and are detailed in:

Mackay, D. (1991). Multimedia Environmental Models: The Fugacity Approach, pp. 67-183, Lewis Publishers, CRC Press.

Mackay, D. et al. (1996). Environ. Toxicol. Chem., 15(9):1618-1626.

Mackay, D. et al. (1996). Environ. Toxicol. Chem., 15(9):1627-1637.

Reliability:

Estimated values based on accepted models.

Additional References for Transport (Fugacity): None Found.

3.4 Biodegradation

Value:	Timeframe:
Linear Model Prediction:	Biodegrades Fast, 0.9975
Non-Linear Model Prediction:	Biodegrades Fast, 0.9879
Ultimate Biodegradation Timeframe:	Weeks-Months, 2.6417
Primary Biodegradation Timeframe:	Days-Weeks, 3.4554
MITI Linear Model Prediction:	Does Not Biodegrade Fast, -0.0039
MITI Non-Linear Model Prediction:	Does Not Biodegrade Fast, 0.0215
Breakdown Products:	No Data
Method:	Modeled. BIOWIN, v. 4.01 module of EPINWIN v3.11 (Syracuse Research Corporation). BIOWIN estimates the probability for the rapid aerobic biodegradation of an organic chemical in the presence of mixed populations of environmental microorganisms. Estimates are based upon fragment constants that were developed using multiple linear and non-linear regression analyses.
GLP:	Not Applicable
Reference:	Boethling, R. S. et al. (1994). <u>Environ. Sci. Technol.</u> , 28:459-65. Howard, P. H. et al. (1992). <u>Environ. Toxicol. Chem.</u> , 11:593-603. Howard, P. H. et al. (1987). <u>Environ. Toxicol. Chem.</u> , 6:1-10. Tunkel, J. et al. (2000). Predicting Ready Biodegradability in the MITI Test. <u>Environ. Toxicol. Chem.</u> , accepted for publication.

Reliability: Estimated values based on accepted models.

Additional References for Biodegradation: None Found.

3.5 Bioconcentration

Value: BCF = 2727 (Estimated Log BCF = 3.436)
Method: Modeled. BCFWIN v. 2.15 module of EPINWIN v3.11 (Syracuse Research Corporation). BCFWIN estimates the bioconcentration factor (BCF) of an organic compound using the compound's log octanol-water partition coefficient (Kow) with correction factors based on molecular fragments.
GLP: Not Applicable
Reference: "Improved Method for Estimating Bioconcentration Factor (BCF) from Octanol-Water Partition Coefficient," SRC TR-97-006 (2nd Update), July 22, 1997; prepared for Robert S. Boethling, EPA-OPPT, Washington, DC, Contract No. 68-D5-0012; prepared by William M. Meylan, Philip H. Howard, Dallas Aronson, Heather Printup and Sybil Gouchie, Syracuse Research Corp.
Reliability: Estimated value based on accepted model.

Additional References for Bioconcentration: None Found.

4.0 Ecotoxicity

4.1 Acute Toxicity to Fish: No Data.

4.2 Acute Toxicity to Invertebrates: No Data.

4.3 Acute Toxicity to Aquatic Plants: No Data.

5.0 Mammalian Toxicity

5.1 Acute Toxicity

Type: Oral LD₅₀
Species/Strain: Male rats/ChR-CD
Value: 1236 mg/kg (95% confidence limits, 930-1640 mg/kg)
Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

The test substance, as an aqueous solution, was administered by intragastric intubation to 4 groups of 10 young adult male ChR-CD rats in single doses of 200, 1000, 1250, and 1500 mg/kg. Clinical signs and body weights were recorded.

Survivors were sacrificed 14 days later without pathological examination. The LD₅₀ value was calculated from the mortality data using the method of D. J. Finney.

GLP: No
Test Substance: Triphenylborane compd. with sodium hydroxide, purity 9 wt% in water
Results: Mortality was 0/10, 2/10, 6/10, and 7/10 at 200, 1000, 1250, and 1500 mg/kg, respectively. Mortality occurred 1-2 days after dosing, with the exception of 1 rat at 1000 mg/kg, which was found dead 13 days after dosing. Sporadic weight loss occurred up to 8 days after dosing at 200 mg/kg. Weight loss occurred up to 3 days after dosing at 1000, 1250, and 1500 mg/kg, with the exception of 1 rat dosed at 1000 mg/kg which lost weight up to 12 days after dosing (this rat was found dead 13 days after dosing). Test days that clinical signs were observed are included in the table below.

Dose (mg/kg):	200	1000	1250	1500
Clinical Sign:				
Alopecia	- ^a	-	7	-
Chromodacryorrhea	-	-	-	2
Congestion	6	3,5-6	-	-
Diarrhea	-	1	0,3	1
Hunched posture	-	12	-	-
Labored breathing	-	11	-	-
Piloerection	-	1,3,5-7, 11-13	0	1
Stained nose/face/mouth	-	2-3	0	1-2
Stained perineal area	-	2-3,5,11, 13	3-4	1,3
Stained underside	-	3	-	-
Weakness	-	11-12	0	-
Wet perineum	-	3	3	1
^a Clinical sign was not observed in any rat at this dose level.				

Reference: DuPont Co. (1978). Unpublished Data, Haskell Laboratory Report No. 493-78, "Oral LD₅₀ Test" (August 25).
Reliability: High because a scientifically defensible or guideline method was used.

Type: Oral ALD
Species/Strain: Male rats/ ChR-CD
Value: 200 mg/kg

Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

GLP: No

Test Substance: Triphenylborane compd. with sodium hydroxide, purity not reported

Results: Mortality was observed from 10 minutes to 1 day at ≥ 200 mg/kg. Clinical signs observed in nonlethal doses included lethargy on the day of dosing and diarrhea for 2 days after dosing at 130 mg/kg; severe respiratory congestion and weight loss beginning on the 9th day after dosing until sacrifice at 90 mg/kg; and weight loss from 1-3 days after dosing at ≥ 40 mg/kg. Clinical signs observed at lethal doses included belly-to-cage posture and lethargy at 200 mg/kg; diarrhea at 200 and 300 mg/kg; prostration at ≥ 300 mg/kg, and pallor at ≥ 200 mg/kg.

Reference: DuPont Co. (1975). Unpublished Data, Haskell Laboratory Report No. 569-75, "Acute Oral Test" (September 22) (also cited in TSCA Fiche [OTS0555551](#)).

Reliability: High because a scientifically defensible or guideline method was used.

Additional References for Acute Oral Toxicity: None Found.

Type: **Inhalation Toxicity:** No Data.

Type: **Dermal Toxicity:** No Data.

Type: **Dermal Irritation**

Species/Strain: Male rabbits/Albino

Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

Six male albino rabbits were clipped free of hair on the trunk and lateral areas and placed in FDA-type stocks. Doses of 0.5 mL undiluted test substance were applied to intact skin under gauze squares. Rubber sheeting was then loosely wrapped around the trunk and secured with adhesive tape. After 24 hours, the rabbits were removed from the stocks,

the patches taken off, and the reactions observed.
Observations were also made at 48 hours.

GLP: No

Test Substance: Triphenylboron compd. with sodium hydroxide, purity not reported

Results: The test substance produced necrosis with severe to moderate edema on the intact skin of 6/6 rabbits in 24 hours.

Reference: DuPont Co. (1975). Unpublished Data, Haskell Laboratory Report No. 604-75, "Skin Irritation Test on Rabbits" (October 22) (also cited in TSCA Fiche [OTS0571606](#)).

Reliability: High because a scientifically defensible or guideline method was used.

Additional References for Dermal Irritation: None Found.

Type: **Dermal Sensitization:** No Data.

Type: **Eye Irritation**

Species/Strain: Rabbits/Albino

Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

One-tenth milliliter of the undiluted test substance was placed into the right conjunctival sac of each of 2 albino rabbits. After 20 seconds, 1 treated eye was washed with tap water for 1 minute. The treated eye of the other rabbit was not washed. Observations of the cornea, iris, and conjunctiva were made with a hand-slit lamp at 1 and 4 hours, and at 1, 2, 3, 7, and 14 days. Fluorescein stain and a biomicroscope were used at examinations after the day of treatment.

GLP: No

Test Substance: Triphenylboron compd. with sodium hydroxide, purity not reported

Results: The test substance was corrosive to the eyes. The test substance produced progressive, generalized moderate, but penetrating corneal opacity, moderate iritis, and severe conjunctivitis with necrosis of the outer lids. At 2 days, the unwashed eye had clouds of precipitate in the anterior chamber indicating deep injury. At 14 days, the cornea appeared somewhat distorted with ½ of the area opalescent. When the rabbit was observed at 17 days, the cornea had outward distortion and the lower ½ appeared hardened. The eye dosed with the test substance and promptly washed was much the same as the unwashed eye.

Reference: DuPont Co. (1975). Unpublished Data, Haskell Laboratory Report No. 603-75, "Eye Irritation Test in Rabbits" (October 22) (also cited in TSCA Fiche OTS0571607).

Reliability: High because a scientifically defensible or guideline method was used.

Additional References for Eye Irritation: None Found.

5.2 Repeated Dose Toxicity: No Data.

5.3 Developmental Toxicity: No Data.

5.4 Reproductive Toxicity: No Data.

5.5 Genetic Toxicity

Type: *In vitro* Bacterial Reverse Mutation Assay

Tester Strain: *Salmonella typhimurium* TA98, TA100, TA1535, TA1537, TA1538

Exogenous Metabolic Activation: With and without Aroclor-induced rat liver homogenate (S9)

Exposure Concentrations: 0, 25, 50, 100, 250, 500 µg/plate (with metabolic activation)

0, 10, 20, 30, 50, 100 µg/plate (without metabolic activation)

Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

The assay was performed in the presence and the absence of a rat-liver homogenate activation system. In the absence of an activation system, a solution of the test substance and approximately 10^8 bacteria were added to top agar. These components were mixed and poured on the surface of a plate containing Davis minimal agar. To treat in the presence of an activation system, S9 mix was added to the bacteria-test substance-top agar mixture. The S9 mix contained S9, MgCl₂, KCl, glucose-6-phosphate, NADP, and sodium phosphate (pH 7.4). The S9 mix was added to the bacteria, test substance, and top agar. The components were mixed and immediately poured over the minimal agar plate. The revertant colonies were counted after the plates were incubated at 37°C for 48 hours.

The cytotoxicity of the test substance in the presence and absence of an activation system, as measured in strain TA1535, was the basis for selecting concentrations to be

used in the mutagenesis experiment. The protocol used to determine the cytotoxicity was identical to the mutagenesis protocol, except that 10^3 rather than 10^8 bacteria were used per plate, and a nonlimiting concentration of histidine was present. Concentrations of the test substance that were nontoxic and, if possible, slightly toxic were selected for the mutagenesis assay.

Positive and negative (solvent) controls were included with each assay. The solvent control was distilled water. The positive controls included 2-aminoanthracene, N-methyl-N'-nitro-N-nitrosoguanidine, 9-aminoacridine, and 2-nitrofluorene.

Data from replicate plates within a single experiment were averaged. The average of the values from different experiments was determined. The highest average number of revertants that was obtained was expressed as a multiple of the control value for the sensitive strain(s). When a test sample was active, the average numbers of revertants observed before activity plateaus or decreases at the various concentrations tested were submitted to linear regression analysis. A test substance was classified as a nonmutagen if the reversion frequency was less than 2 times the spontaneous frequency, and if less than 0.02 revertants/mole were observed.

GLP: No
Test Substance: Triphenylborane compd. with sodium hydroxide, purity 9 wt%
Results: Negative
Remarks: The test substance was not mutagenic in any strain tested in the presence or absence of an activation system.
Reference: DuPont Co. (1978). Unpublished Data, Haskell Laboratory Report No. 305-78, "Mutagenic Activity in the *Salmonella*/Microsome Assay" (June 9).
Reliability: High because a scientifically defensible or guideline method was used.

Additional References for *In vitro* Bacterial Reverse Mutation Assay: None Found.

Type: ***In vitro* Mammalian Cell Gene Mutation Study**
Cell Type: Chinese Hamster Ovary (CHO) cells
Exogenous Metabolic Activation: With and without Aroclor-induced rat liver homogenate (S9)
Exposure: Without S9:

Concentrations: Trial #1: 0, 17.7, 26.5, 35.4, 44.3 μM
Trial #2: 0, 17.7, 26.5, 35.4, 44.3, 53.1 μM
Trial #3: 0, 17.7, 35.4, 70.9, 88.6 μM

With S9:

Trial #1: 0, 35.4, 88.6, 177.3, 212.7, 248.2, 265.9 μM
Trial #2: 0, 35.4, 88.6, 177.3, 212.7, 248.2, 265.9, 283.6 μM
Trial #3: 0, 35.4, 88.6, 177.3, 212.7, 248.2, 265.9, 283.6 μM
Trial #4: 0, 141.8, 177.3 μM
Trial #5: 0, 177.3, 212.7, 230.4, 248.2, 265.9, 283.6 μM

Method: No specific test guideline was reported; however, a scientifically defensible approach was used to conduct the study.

A preliminary cytotoxicity evaluation of the test substance was performed to select concentrations for mutagenesis testing. In general, concentrations that kill from 0% to 90% of the cells were chosen. The cytotoxic and mutagenic activities of the test substance were evaluated in the mutagenesis assay. All assays were performed in the presence and absence of a metabolic activation system composed of rat-liver homogenate and cofactors.

In the mutagenesis assay, 1×10^6 cells were treated with each concentration of test substance. The cells were exposed to the test substance for 5 hours in the activated assay and 18 hours in the nonactivated assay. For every concentration of test substance, cell survival was determined 24 hours after beginning exposure by plating some of the treated cells at a low density. The number of colonies that arose after 7 days incubation was an indication of how well the cells survived treatment. Other cells from the same treatment level were plated at a high density and maintained in an exponential growth phase for 7 days to permit expression of the mutant phenotype. At the end of this period, 1×10^6 cells were placed in medium containing 6-thioguanine (6-TG) to select for 6-IG resistant mutants. Resistant cells formed colonies that were visible when stained 1 week later. Also at the time of selection, some cells were plated at a low density in 6-TG free medium to determine the percentage of cells that were viable at that time. This indicated the actual number of cells from which the mutants were selected.

The S9 was diluted in KCl. In addition, the treatment medium contained $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$, NADP, glucose-6-phosphate, and NADH.

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All mutagenesis assays included solvent control and positive controls. The solvent control was distilled water, and the positive controls included ethylmethane sulfonate and dimethylnitrosamine. All dose levels were done in duplicate and all experiments were performed at least twice.

GLP: No
Test Substance: Triphenylborane compd. with sodium hydroxide, purity 9 wt% in water
Results: Negative
Remarks: Toxicity was observed at higher concentration. When added to the treatment medium, the test substance stayed in solution. The test substance was not mutagenic to cultured Chinese Hamster Ovary (CHO) cells. The statistical analyses showed no significant increase in the mutation frequency over the control.
Reference: DuPont Co. (1979). Unpublished Data, Haskell Laboratory Report No. 369-79, "Mutagenic Activity in the Chinese Hamster Ovary Assay" (June 15).
Reliability: High because a scientifically defensible or guideline method was used.
Type: *In vivo Genetic Toxicity:* No Data.