TETRABUTYL TITANATE

TBT

CAUTIONARY RESPONSE INFORMATION

Common Synonyms			
Butyl titanate Butyl titanate monomer Orthotitanic acid, tetrabutyl ester Titanium butoxide Titanium tetrabutoxide	Liquid	Colorless to light yellow	Weak alcohol-like odor
	May float or sink in water. Reacts with water.		

Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Notify local health and pollution control agencies.
Protect water intakes.

Fire

Combustible.
Containers may explode in fire.
Extinguish with dry chemicals or carbon dioxide.
DO NOT USE WATER ON FIRE.
Cool exposed containers with water.

Exposure

Call for medical aid.

LIQUID
Irritating to skin and eyes.
If swallowed will cause nausea and vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
Stop discharge

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
2.2 Formula: $Ti(OC_4H_9)_4$
2.3 IMO/UN Designation: Not listed
2.4 DOT ID No.: Not listed
2.5 CAS Registry No.: Currently not available
2.6 NAERG Guide No.: Not listed
2.7 Standard Industrial Trade Classification: 51550

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Self-contained breathing apparatus or organic canister mask; goggles or face shield; rubber gloves
3.2 Symptoms Following Exposure: Inhalation causes nonspecific irritation of the upper respiratory tract. Contact with liquid may cause corneal damage in eyes and local irritation of skin. Ingestion causes nonspecific irritation of gastrointestinal tract, nausea, vomiting, cramps, and diarrhea; in severe cases, central nervous system depression may result.
3.3 Treatment of Exposure: INHALATION: move from contaminated atmosphere; if symptoms of respiratory discomfort persist, see a physician. EYES: immediately flush with large quantities of running water for a minimum of 15 min.; obtain medical attention if irritation persists. SKIN: immediately flush affected areas with water; obtain medical attention if irritation persists. INGESTION: give large amounts of water or warm salty water to induce vomiting; if this measure is unsuccessful, vomiting may be induced by tickling the back of the patient's throat with a finger; vomiting should be encouraged until vomitus is clear; obtain medical attention if abdominal discomfort persists.
3.4 TLV-TWA: Not listed.
3.5 TLV-STEL: Not listed.
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Currently not available
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Currently not available
3.10 Vapor (Gas) Irritant Characteristics: Currently not available
3.11 Liquid or Solid Characteristics: Currently not available
3.12 Odor Threshold: Currently not available
3.13 IDLH Value: Not listed.
3.14 OSHA PEL-TWA: Not listed.
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: 170°F C.C.
4.2 Flammable Limits in Air: 2%-12%
4.3 Fire Extinguishing Agents: Dry chemical, carbon dioxide
4.4 Fire Extinguishing Agents Not to Be Used: Water
4.5 Special Hazards of Combustion Products: Not pertinent
4.6 Behavior in Fire: May give off dense white smoke. Containers may explode.
4.7 Auto Ignition Temperature: Currently not available
4.8 Electrical Hazards: Currently not available
4.9 Burning Rate: 3.4 mm/min.
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: 114.2 (calc.)
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): 35.0 (calc.)
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: Reacts to form butanol and titanium dioxide; the reaction is not hazardous.
5.2 Reactivity with Common Materials: No reaction
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity: Currently not available
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): Currently not available
6.4 Food Chain Concentration Potential: Currently not available
6.5 GESAMP Hazard Profile: Not listed

7. SHIPPING INFORMATION

7.1 Grades of Purity: Technical
7.2 Storage Temperature: Ambient
7.3 Inert Atmosphere: No requirement
7.4 Venting: Open (flame arrester)
7.5 IMO Pollution Category: Currently not available
7.6 Ship Type: Currently not available
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Not listed
8.2 49 CFR Class: Not pertinent
8.3 49 CFR Package Group: Not listed.
8.4 Marine Pollutant: No
8.5 NFPA Hazard Classification: Not listed
8.6 EPA Reportable Quantity: Not listed.
8.7 EPA Pollution Category: Not listed.
8.8 RCRA Waste Number: Not listed
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: 340
9.3 Boiling Point at 1 atm: 593°F = 312°C = 585°K
9.4 Freezing Point: –67°F = –55°C = 218°K
9.5 Critical Temperature: Not pertinent
9.6 Critical Pressure: Not pertinent
9.7 Specific Gravity: 0.998 at 25°C (liquid)
9.8 Liquid Surface Tension: Currently not available
9.9 Liquid Water Interfacial Tension: Not pertinent
9.10 Vapor (Gas) Specific Gravity: Not pertinent
9.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
9.12 Latent Heat of Vaporization: 142 Btu/lb = 79 cal/g = 3.3 X 10^5 J/kg
9.13 Heat of Combustion: (est.) –14,600 Btu/lb = –8,100 cal/g = –340 X 10^5 J/kg
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: Currently not available

NOTES

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9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
34	62.420	51	0.350	51	0.645	52	150.500
36	62.420	52	0.350	52	0.645	54	140.799
38	62.420	53	0.350	53	0.645	56	131.699
40	62.420	54	0.350	54	0.645	58	123.299
42	62.420	55	0.350	55	0.645	60	115.500
44	62.420	56	0.350	56	0.645	62	108.200
46	62.420	57	0.350	57	0.645	64	101.500
48	62.420	58	0.350	58	0.645	66	95.160
50	62.420	59	0.350	59	0.645	68	89.299
52	62.420	60	0.350	60	0.645	70	83.839
54	62.420	61	0.350	61	0.645	72	78.759
56	62.420	62	0.350	62	0.645	74	74.020
58	62.420	63	0.350	63	0.645	76	69.589
60	62.420	64	0.350	64	0.645	78	65.459
62	62.420	65	0.350	65	0.645	80	61.600
64	62.420	66	0.350	66	0.645	82	58.000
66	62.420	67	0.350	67	0.645	84	54.630
68	62.420	68	0.350	68	0.645	86	51.480
70	62.420						
72	62.420						
74	62.420						
76	62.420						

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	REACTS		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT