MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

SRM Number: 3000
MSDS Number: 3000
SRM Name: Benzene in Methanol

Date of Issue: 04 February 2013

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Description: This Standard Reference Material (SRM) is a gravimetrically prepared single-compound solution (benzene) in methanol intended primarily for the calibration of instrumentation and validation of methods for volatile organic compound (VOC) determinations. A unit of SRM 3000 consists of two 5 mL sealed borosilicate glass ampoules of a gravimetrically prepared solution of benzene in methanol. Approximately 2.5 mL of this mixture is supplied in each 5 mL glass ampoule.

Substance: Benzene/Methanol Solution

Other Designations: Methanol (Wood alcohol; wood spirit; methyl hydroxide; methyl alcohol); Benzene (benzol; cyclohexatriene; benzole; phene; pyrobenzol; pyrobenzole; coal tar naphtha; phenyl hydride; benzolene)

2. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 2 Fire = 3 Reactivity = 0

Major Health Hazards: Skin and eye irritation, central nervous system depression, aspiration hazard, and nerve damage.

Physical Hazards: Flammable liquid and vapor. Vapor may cause flash fire.

Potential Health Effects (Acute and Chronic)

Inhalation: Methanol can cause irritation of the mucous membranes, coughing, ringing in the ears, constipation, recurrent headaches, drowsiness, dizziness, tingling sensation, tremors, loss of coordination, enlargement of the liver, blood disorders, oppression in the chest, tracheitis, bronchitis, tinnitus, unsteady gait, twitching, colic, nystagmus, blepharospasm, and nerve damage. Occupational exposure symptoms include paresthesias, numbness and shooting pains in the hands and forearms. Metabolic acidosis and effects on the eyes and central nervous system may occur.

Benzene can cause irritation, nausea, vomiting, chest pain, difficulty breathing, irregular heartbeat, headache, drowsiness, dizziness, disorientation, sleep disturbances, mood swings, tremors, loss of coordination, blurred vision, lung congestion, internal bleeding, blood disorders, paralysis, and coma.

Skin Contact: Methanol can cause irritation; skin absorption may occur and cause metabolic acidosis and effects on the eyes and central nervous system. Repeated or prolonged contact may cause defatting of the skin resulting in erythema, scaling, and eczematoid dermatitis. Chronic absorption may result in headache, drowsiness, dizziness, loss of coordination, and blood disorders.

Benzene is potentially fatal on contact with the skin.

Eye Contact: Methanol vapors may cause irritation and eye damage. Concentrated solutions have been reported to cause violent inflammation of the conjunctiva and epithelial defects on the cornea. Repeated or prolonged contact may cause conjunctivitis.

Benzene may cause irritation; long term exposure may result in conjunctivitis.

Ingestion: Ingestion of methanol may result in mild and transient inebriation and subsequent drowsiness. Liver, kidney, heart, stomach, intestine and pancreatic damage may also occur. Death may occur due to respiratory failure. As little as 15 mL has caused blindness; the usual fatal dose is 60–240 mL.

Benzene, if ingested, can cause irritation, nausea, vomiting, chest pain, difficulty breathing, irregular heartbeat, headache, drowsiness, convulsions, and coma. Potential aspiration hazard if ingested. Chronic effects may result in kidney damage and cancer.

Listed as a Carcinogen/Potential Carcinogen

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	X[(a)]	
In the International Agency Report on Carcinogens (IARC) Monographs	X[(b)]	
By the Occupational Safety and Health Administration (OSHA)	X[(c)]	

[(a)] NTP lists benzene as a known human carcinogen; IARC lists benzene as Group 1 (carcinogenic to humans); OSHA lists benzene on Appendix D, OSHA Designated Carcinogens of 29 CFR 1910, Subpart Z.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Nominal Mass Concentration[(a)] (%)
Methanol	67-56-1	200-659-6	99
Benzene	71-43-2	200-753-7	1

[(a)] Hazardous components 1 % or greater; carcinogens 0.1 % or greater are listed in compliance with OSHA 29 CFR 1910.1200.

Component: Methanol (Concentration ≥ 20 %)

EC Classification: T, F
EC Risk (R No.): 11, 23/24/25, 39/23/24/25
EC Safety (S No.): 7, 16, 36/37, 45

Component: Benzene

EC Classification: T, F; Carc. Cat. 1, Muta. Cat. 2
EC Risk (R No.): 11, 48/23/24/25, 36/38, 45, 46, 65
EC Safety (S No.): 45, 53

EC Risk/Safety Phrases: Refer to Section 15, "Regulatory Information".

4. FIRST AID MEASURES

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

Ingestion: Potential aspiration hazard if ingested. If swallowed, do not induce vomiting. Seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Severe fire hazard. Vapor/air mixtures are explosive. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

Extinguishing Media: Alcohol-resistant foam, carbon dioxide, regular dry chemical, water.

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Note: The data listed below is for methanol.

Flash Point: 11 ºC (52 ºF)
Method Used: Closed Cup

Autoignition Temp: 385 ºC (725 ºF)

Flammability Limits in Air
UPPER (Volume %): 36
LOWER (Volume %): 6

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Avoid heat, flames, sparks and other sources of ignition. Do not touch spilled material. Stop leak if possible without personal risk. Reduce vapors with water spray. Absorb small spills with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry.

Disposal: Refer to Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Handling and Storage: Store and handle in accordance with all current regulations and standards. Sealed ampoules should be stored in the dark at temperatures between 10 °C and 30 °C. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Keep separated from incompatible substances.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits

Component: Methanol

ACGIH (TLV): 200 ppm (TWA); 250 ppm (STEL);
Skin – potential significant contribution to overall exposure by the cutaneous route.
OSHA (PEL): 200 ppm, 260 mg/m^3 (TWA)
NIOSH (REL): 200 ppm, 260 mg/m^3 (TWA); 250 ppm, 325 mg/m^3 (STEL); 6000 ppm (IDLH);
Potential for dermal absorption.

Component: Benzene

ACGIH (TLV): 0.5 ppm (TWA); 2.5 ppm (STEL)
Skin – potential significant contribution to overall exposure by the cutaneous route
OSHA (PEL): 1 ppm (TWA), 10 ppm (TWA) (applies to industry segments exempt from the benzene standard at 29 CFR 1910.1028)
5 ppm (STEL) (See 29 CFR 1910.1028, 15 min); 0.5 ppm (Action Level); 25 ppm (Ceiling)
NIOSH (REL): 0.1 ppm (TWA); 1 ppm (STEL); 500 ppm (IDLH)

Ventilation: Use local exhaust ventilation system. Ensure compliance with applicable exposure limits.

Respirator: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29 CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye Protection: Wear chemical safety goggles. An eyewash station should be readily available near areas of use.

Personal Protection: Wear appropriate protective clothing and chemically resistant gloves to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component	Methanol	Benzene
Appearance and Odor	clear and colorless liquid, alcohol odor (threshold 100 ppm)	colorless to yellow liquid, distinct odor (threshold 4.7 ppm)
Molecular Formula	CH_3OH	C_6H_6
Molar Mass (g/mol)	32.04	78.11
Specific Gravity (water = 1)	0.79	0.88 @ 20 °C
Vapor Density (air = 1)	1.11	2.8
Boiling Point (°C)	65 (149 °F)	80 (176 °F)
Viscosity	0.59 cP 20 °C	0.65 cP 20 °C
Melting Point (°C)	–94 (–137 °F)	6 (43 °F)
Water Solubility	soluble	0.18 % @ 25 °C
Solvent Solubility	ether, benzene, alcohol, acetone, chloroform, ethanol, ketones, organic solvents	acetone, alcohol, carbon disulfide, ether, carbon tetrachloride, chloroform, acetic acid, oils, organic solvents

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for the solution of benzene in methanol. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable _____ Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Avoid heat, flames, sparks, and other sources of ignition. Ampoules may rupture or explode if exposed to heat. Keep out of water supplies and sewers. Avoid inhalation of material or combustion by-products.

Incompatible Materials: Halo carbons, combustible materials, metals, oxidizing materials, halogens, metal carbide, bases, acids, amines, and metal salts.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Oxides of carbon, various organic fragments.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Toxicity Data:

Component: Methanol
Rat, Oral LD_{50}: 5628 mg/kg
Rabbit, Skin LD_{50}: 15 800 mg/kg
Rat, Inhalation LC_{50}: 83.2 mg/L (4 h); 64 000 ppm (4 h)

Component: Benzene
Rat, Oral LD_{50}: 930 mg/kg
Rat, Inhalation LC_{50}: 13 000–14 380 ppm (4 h)

Target Organ(s): Central nervous system, immune system (blood)

Health Effects (Acute and Chronic): See Section 2, "Hazards Identification" for potential health effects.

Medical Conditions Aggravated by Exposure: Allergies and disorders of the blood system, immune system, eye, skin, and kidney.

Mutagen/Teratogen: The components of this material have been reviewed and the Registry of Toxic Effects of Chemical Substances (RTECS) publishes the following endpoints.

Component: Methanol
Tumorigenic: Rat, Inhalation TCLo: 1000 ppm (2 years)
Mutagenic: Human: 300 mmol/L
Reproductive: Mouse, Inhalation TCLo: 2000 ppm (pregnant 6–15 d)

Component: Benzene
Tumorigenic: Human, Inhalation TC: 150 ppm (15 min)
Mutagenic: Human: 0.1 ppm; 1 mg/L
Reproductive: Mouse, Inhalation TCLo: 500 mg/m^3 (12 h, pregnant 6–15 d)

12. ECOLOGICAL INFORMATION

Ecotoxicity Data

Component: Methanol
Fish Toxicity: Fathead minnow (*Pimephales promelas*) LC_{50} (static): >100 mg/L (96 h)
Rainbow trout (*Oncorhynchus mykiss*) LC_{50} (static): 18–20 mL/L (96 h)

Component: Benzene
Fish Toxicity: Fathead minnow (*Pimephales promelas*) LC_{50} (flow-through): 10.7–14.7 mg/L (96 h)
Rainbow trout (*Oncorhynchus mykiss*) LC_{50} (flow-through): 5.3 mg/L (96 h)
Algae: *Pseudokirchneriella subcapitata* EC_{50}: 29 mg/L (72 h)
Invertebrate: Water flea (*Daphnia magna*) EC_{50} (static): 8.76–15.6 mg/L (48 h)

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose in accordance with all applicable federal, state, and local requirements. Subject to disposal regulations: U.S. EPA 40 CFR 262; Hazardous Waste Number(s): U154 (methanol); D018, 0.5 mg/L regulatory level (benzene).

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN1230, Methanol solution, Hazard Class 3 (6.1), PG II, Excepted Qty: Yes, E2.

15. REGULATORY INFORMATION

U.S. Regulations

CERCLA Sections 102a/103 (40 CFR 302.4): 5000 lb (2270 kg) final RQ for methanol; 10 lb (4.54 kg) final RQ for benzene.
SARA Title III Section 302 (40 CFR 355.30): Not regulated for this material.
SARA Title III Section 304 (40 CFR 355.40): Not regulated for this material.
SARA Title III Section 313 (40 CFR 372.65): 1.0 % de minimis concentration for methanol; 0.1 % de minimis concentration for benzene.
OSHA Process Safety (29 CFR 1910.119): Not regulated for this material.
SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes
CHRONIC:	Yes
FIRE:	Yes
REACTIVE:	No
SUDDEN RELEASE:	No

State Regulations

California Proposition 65: Keep out of water supplies and sewers. WARNING! This product contains a chemical (benzene) known to the state of California to cause cancer. WARNING! This product contains chemicals (benzene and methanol) known to the state of California to cause reproductive/developmental effects.

Canadian Regulations

WHMIS Classification: Not provided for this material.

European Regulations

Component: Methanol (Concentration ≥ 20 %)

EC Classification: F: Flammable, T: Toxic

EC Risk Phrases:
R11 – Highly flammable.
R23/24/25 – Toxic by inhalation, in contact with skin and if swallowed.
R39/23/24/25 – Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

EC Safety Phrases:
S7 – Keep container tightly closed.
S16 – Keep away from sources of ignition – No smoking.
S36/37 – Wear suitable protective clothing and gloves.
S45 – In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

Component: Benzene

EC Classification: F: Flammable, T: Toxic; Carc. Cat. 1, Muta. Cat. 2

EC Risk Phrases:
R11 – Highly flammable.
R48/23/24/25 – Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R36/38 – Irritating to eyes and skin.
R45 – May cause cancer.
R46 – May cause heritable genetic damage.
R65 – Harmful: may cause lung damage if swallowed.

EC Safety Phrases:
S45 – In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S53 – Avoid exposure - obtain special instructions before use.

National Inventory Status

U.S. Inventory (TSCA): Methanol and benzene are listed.

TSCA 12(b); Export Notification: Not listed.

16. OTHER INFORMATION

Sources: ChemAdvisor, Inc., MSDS *Benzene*, 03 December 2012.

ChemAdvisor, Inc., MSDS *Methyl Alcohol*, 03 December 2012.

EC; European Chemical Substance Information System (ESIS), *Benzene*, CAS No. 71-43-2; available at http://esis.jrc.ec.europa.eu/ (accessed Jan 2013).

EC; ESIS, *Methanol*, CAS No. 67-56-1; available at http://esis.jrc.ec.europa.eu/ (accessed Jan 2013).