Methanol Safety & Handling Manual

IMDG CODE CLASS 3 (SUBSIDIARY 6.1) | UN 1230 OPERATIONS

TENDIFY SAFETY UTILITIES
HSE & Marine Terminal Guidelines

UN NUMBER / CLASS	CAS REGISTRY NO.	PACKING GROUP	EMERGENCY ACTION
UN 1230 / Class 3 (6.1)	67-56-1	PG II (Moderate Danger)	ERG Guide 131

1. PHYSICAL PROPERTIES & PRIMARY CLASSIFICATION HAZARDS

Dual Danger: Flammable & Toxic

1.1 Dual Hazard Profile: Flammability & Acute Toxicity

Class 3 + 6.1

Methanol (CH_3OH) is a highly flammable, clear, colorless liquid. It presents a dual threat: **Primary Class 3 (Flammable Liquid)** with a low flashpoint (11°C) and a wide flammability range (6.0%–36.5% vol), and **Subsidiary Class 6.1 (Toxic Substance)** due to rapid absorption through skin, inhalation, or ingestion leading to metabolic acidosis, optic nerve destruction (blindness), and systemic fatal toxicity.

PHYSICOCHEMICAL PROPERTY	METRIC VALUE	SAFETY & OPERATIONAL SIGNIFICANCE
Flash Point (Closed Cup)	**11.0 °C (51.8 °F)**	Requires explosive-proof (Ex d) electrical gear at ambient temps.
Auto-Ignition Temperature	**464.0 °C**	High ignition threshold, but burns with an invisible pale-blue flame.
Explosive Limits (LEL / UEL)	**6.0% – 36.5% vol**	Extremely wide flammability margin in air vs crude/gasoline.
Vapor Density (Air = 1)	**1.11**	Heavier than air; vapor accumulates in low spots and sumps.
Vapor Pressure (20 °C)	**12.8 kPa (96 mmHg)**	High volatility; mandatory vapor recovery (VRU) during transfer.

2. NITROGEN (N_2) BLANKET & STORAGE TANK INERTING

Inerting Mandate

2.1 Inert Gas Blanket (N_2) Operating Criteria

To eliminate explosive atmospheres in land storage tanks and marine cargo holds, a positive dry Nitrogen (N_2) blanket must be continuously maintained.

- **Maximum Oxygen Concentration:** O_2 levels inside tank headspace must remain strictly **below 8.0% by volume** (target $\le 5.0\%$).
- **Padding Pressure:** Maintain positive tank headspace pressure at **20–50 mbar (0.02–0.05 bar)** to prevent ingress of atmospheric air and moisture.
- **Dew Point Requirement:** Nitrogen supply dew point must be **$\le -40^\circ\text{C}$** to preserve product purity and prevent internal corrosion.

CRITICAL INVISIBLE FLAME WARNING: Methanol burns in daylight with a virtually invisible pale-blue flame emitting no smoke or radiant heat. Personnel must utilize thermal imaging cameras (FLIR) or handheld heat sensors when responding to potential fire alarms in methanol handling zones.

3. FIREFIGHTING & SPILL MITIGATION PROTOCOLS

Emergency Response

3.1 Approved Fire Suppression Media

AR-AFFF Mandatory

• **Mandatory Foam Type:** Use ONLY **Alcohol-Resistant Aqueous Film-Forming Foam (AR-AFFF)** at 3% or 6% concentration. Standard protein or conventional AFFF foams are destroyed instantly upon contact with polar solvents like methanol.
• **Water Fog / Spray:** Use water spray ONLY to cool surrounding unignited tanks and equipment. *Do not apply direct water jet into burning liquid* as methanol is miscible with water and will spread the fire unless diluted to below 20% concentration.
• **Small Fires:** Carbon dioxide (CO_2), dry chemical powder (BC/ABC), or alcohol-resistant foam extinguishers.

3.2 Marine & Terminal Spill Containment Procedures

1. **Evacuation & Isolation:** Immediately isolate spill area for at least 50 meters in all directions. Eliminate all ignition sources (no smoking, spark-producing tools, or non-Ex equipment).
2. **Vapor Suppression:** Apply AR-AFFF foam blanket over the liquid pool to suppress dangerous vapor release and lower explosive mix risk.
3. **Environmental Containment:** Prevent runoff from entering sewers, waterways, or marine docks. Dike far ahead of liquid spill using non-combustible absorbent material (vermiculite or dry sand).

4. OCCUPATIONAL EXPOSURE LIMITS & FIRST AID ACTIONS

Medical Emergency Protocol

EXPOSURE STANDARD	THRESHOLD LIMIT	MANDATORY PPE / CONTROLS
OSHA PEL / ACGIH TLV-TWA	**200 ppm (260 mg/m^3)**	8-hour work shift baseline limit; continuous gas monitoring.
ACGIH STEL (Short-Term)	**250 ppm (325 mg/m^3)**	15-minute maximum exposure threshold (Skin notation).
IDLH (Immediate Danger)	**6,000 ppm**	Mandatory Supplied Air Respirator (SCBA / Positive Pressure).

👁️ **Eye / Skin Exposure**

Eyes: Flush immediately with eyewash water for ≥ 15 minutes holding eyelids open.
Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water. Methanol rapidly absorbs cutaneously.

🫁 **Inhalation Emergency**

Move victim immediately to fresh air. If not breathing, administer artificial respiration (use pocket mask; avoid mouth-to-mouth). Administer supplemental Oxygen if trained.

🚨 **Ingestion & Medical Antidote Protocol (Hospital Treatment)**

DO NOT INDUCE VOMITING unless directed by medical personnel. Ingestion of as little as 10–30 mL can be fatal.
Hospital Antidote Note: Inform emergency physicians of methanol ingestion immediately. Medical treatment involves competitive inhibition of alcohol dehydrogenase via **Fomepizole (4-methylpyrazole)** or intravenous Ethanol, followed by hemodialysis if metabolic acidosis develops.

24/7 GLOBAL CHEMICAL EMERGENCY RESPONSE HOTLINE
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CALL 112 / 911