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Methanol Safe Berthing: Best Practices

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SINGAPORE
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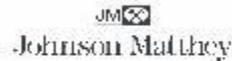
- World's leading methanol producers
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- To traditional markets & derivatives
- Leads the development of new emerging markets and applications
- Delivers safe handling tools to global distribution chain



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- Global Petrochemicals and Chemicals Association
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Methanol Safe Handling and Safe Berthing: Setting New Industry Standards (A Methanol Institute Initiative)



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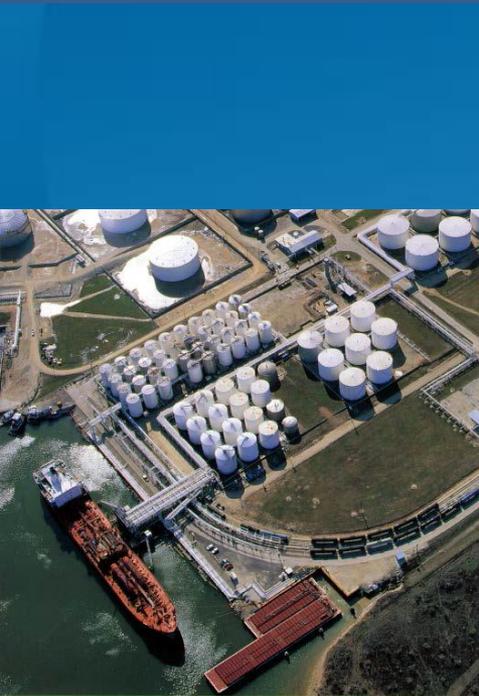
- International Logistics Advisors -

- As the methanol industry grows, the safe handling of our product is the single most important thing we do as an industry. A spill, a fire or an explosion affects everyone in the industry. Additionally, being stewards of the environment has also played a key role in formulating our recommendations to the industry.
- The chance to improve both safety and how we impact the environment prompted the Methanol Institute to engage **Distribution Consulting Services** of Houston to help quantify best practices and introduce new guidelines for terminals and for the safe berthing, loading and discharge of methanol ships and barges.
- We would like to acknowledge the following persons and organizations whose contributions in the development of these guidelines were invaluable. Edgard Jimenez of **Waterfront Shipping/Methanex, SABIC, SABTANK, Intercontinental Terminals Company (ITC), AMPCO, Mitsui O.S.K. Lines (MOL), LBC Tank Terminals, Stolt Terminals and Tankers, Odfjell Terminals, Core Laboratories/Saybolt, Inspectorate, Intertek/Caleb Brett, Amspec, SGS, the Pilot Associations of Lake Charles, the Sabine Pilots, and the Houston Pilots.**

Methanol Safe Handling Risks

- **While many of us view Methanol as a relatively safe chemical to handle, it can raise concerns if improperly handled.**
 - Methanol is flammable and has a low flash point, so there is a risk of explosion with an oxygen methanol vapor mixture or a fire risk if spilled.
 - Methanol can cause serious health problems or death if someone drinks it or has excessive exposure to methanol vapors or prolonged contact with the skin.
 - Over the years ship operators and terminal operators have made significant progress in introducing new safety procedures and new safer designs to minimize these risks.
 - In its work for the Methanol Institute, DCS has highlighted industry best practices and set guidelines for the industry to follow.
 - A technical bulletin and 6 checklists have been developed as part of this effort:
 - **Declaration of Security**
 - **Declaration of Inspection**
 - **Methanol Personal Protective Equipment (PPE)**
 - **Marine Terminal Checklist**
 - **Marine Vessel/Barge Checklist**
 - **Terminal and Vessel Pre/Post Transfer Checklist & Time Log**

Highlighting Some of the Major Recommendations



- **The bulletin and checklist highlight a number of recommended and new mandatory practices we expect the industry to adopt.**
 - Many of these recommendations are already being or have been adopted by most of the industry.
 - Others are new and are slowly being considered and adopted.
 - Others will be mandatory over time like the new IMO inerting regulation for new tankers built in the coming years.

Example of Major Recommendations



Vapor Destruct Unit

- **Current practice in many parts of the world is to discharge methanol vapors into the atmosphere during vessel or barge loading by releasing them from the ship's vents.**
 - This has a detrimental effect on the environment and also raises the possibility of seamen working on the deck of the vessel or terminal operators near the vessel being overly exposed to methanol vapors.
 - This exposure risk, while small, is still a possibility.
 - We are recommending that all new methanol plants under construction now or in the future include a vapor return system from the dock to the shore to either a vapor destruction unit, a vapor absorption unit or to a tank for vapor balancing.
 - We are also recommending that existing production units around the world consider modifying their loading procedures to include a vapor return system.
 - All ships loading methanol everywhere in the world are already equipped to return vapors to shore.
 - It is also recommended that units that do not return vapors to shore equip vessel deck workers and terminal workers with methanol exposure monitors to monitor their exposure.

Example of a New Mandatory Practice



**Methanol Tanker
Bunga Alpina
2012 Fire**

- **Current practice by many inspectors/surveyors is to open the vessel hatch for visual inspection and for sampling.**
 - We recommend **without exception** that tank hatches never be opened by surveyors or anyone else to either take samples or make a visual inspection of the tank.
 - This practice of open hatches is very common and very dangerous and may have led to or contributed to a number of serious accidents.
 - It exposes personnel to potentially harmful vapors.
 - It is a fire/explosion risk.
 - For vessels with N₂ blanketing opening the hatch is impractical and there are other potential dangers, as these tanks usually have a positive pressure.
 - It is totally unnecessary as samples can be taken by other more efficient and safer means.
 - We recommend that one foot samples be taken from the pump stack after recirculation.

Highlighting Some of the Major Considerations



Methanol Wall Wash Test

- **Wall wash testing to determine the cleanliness of the tanks:**
 - We recommend that this practice should be used only when absolutely necessary. Experienced vessel owners with 30 years of methanol transport experience know how to clean their ship tanks back to methanol after carrying another cargo without the need to enter the tanks.
 - This practice of wall wash sampling is very common and dangerous. It exposes personnel to potentially harmful vapors and tank entry is always a risk.
 - The surveyor could become overwhelmed with vapors from prior cargo, cleaning compounds or nitrogen.
 - The test itself requires the spraying of methanol on the tank walls which can lead to the surveyor breathing in dangerous amounts of methanol.
 - A knowledgeable owner familiar with his vessel does not need to do this test; he already knows how to clean his tanks.
 - For owners familiar with methanol and experienced with tank cleaning we recommend that the wall wash not be done and that a one foot sample be taken from the pump stack after recirculation.
 - Some owners and producers have already adopted this policy.

DCS Has Also Provided Safety Checklists for Terminals, Ships & Barges

- **Safe operations for methanol loading and discharge involve a complex set of procedures to assure that every precaution possible is met with regard to safety.**
 - With the aid of member partners DCS has developed a set of checklists which outline the procedures necessary for safe operations.
 - The checklists are based on the best practices in our industry, and standard forms have been created and made a part of this Technical Bulletin. A conscious effort to implement these procedures will lead to overall improvements in personnel safety, dock and terminal safety, and vessel safety reducing the risks of spills, fires and explosions. The checklists include the following:
 - Declaration of Security
 - Declaration of Inspection
 - Methanol Personal Protective Equipment (PPE)
 - Marine Terminal Checklist
 - Marine Vessel/Barge Checklist
 - Terminal and Vessel Pre/Post Transfer Checklist & Time Log



Declaration of Security Checklist

- **Declaration of Security**
 - **With heightened security at ports around the world, this is a mandatory checklist the vessel/port and terminal personnel perform together.**
 - Assures communication links are in place and operable.
 - Assures the most strategic points during the loading or discharged operations are fully secured and personnel are on duty 24/7.
 - Includes monitoring restricted areas
 - Controlling the delivery of stores
 - Controlling the movement of personnel
 - Controlling access to the vessel
 - Controlling access to the terminal
 - Controlling use of electronic devices



Declaration of Inspections Checklist

- **Declaration of Inspections**

- **Is a general safety inspection of the vessel and port/terminal berth to assure the following:**

- Confirmation the Declaration of Security has been completed first.
- All fire fighting equipment is located and functional.
- All communication procedures are in place.
- All required manuals and port certifications are readily available.
- Emergency procedures are in place.
- All personal protective equipment is available and readily accessible.
- All tools required to perform the work are available and readily accessible.
- All liquid level alarms have been tested and are operational.
- All mooring lines have been properly secured.
- Pre-Transfer meeting held.
- Product transfer arrangements have been checked and verified.



Vessel Checklist

- **Vessel Checklist**
 - **Is a detailed safety/operational inspection of the vessel to assure the following:**
 - Personal protective equipment and procedures checked for handling methanol.
 - Cargo load/discharge plan reviewed.
 - Firefighting equipment checked.
 - Safety protection equipment checked.
 - Emergency alarms checked.
 - Handrails and safety chains in place.
 - Vapor return system checked.
 - Ballast system checked.
 - Pumps and piping checked.
 - Mooring lines checked.



Terminal Checklist

- **Terminal Checklist**
 - **Is a detailed safety/operational inspection of the terminal to assure the following:**
 - The terminal has all its equipment functional and ready to load or discharge methanol to or from a vessel or barge.
 - Personal protective equipment and procedures checked for handling methanol.
 - Cargo load/discharge plan reviewed.
 - Firefighting equipment checked.
 - Safety protection equipment checked.
 - Emergency alarms checked.
 - Vapor return system checked.
 - Pumps and piping checked.



Personal Protective Equipment Checklist



- **Personal Protective Equipment Checklist**
 - Although every effort should be taken to prevent leaks or spills during the connection of hoses, loading arms or taking samples, personnel should protect them from a methanol release.
 - Personal Protective Equipment is a list of equipment which should be available in case of a spill or worn during certain activities.
 - Items include such things as personal respirators.
 - Personal vapor monitoring devices to track exposure.
 - It also includes the usual hard hats, safety glasses, safety shoes, etc.



Terminal and Vessel Transfer Checklist



- **Terminal and Vessel Transfer Checklist**
 - **Is a detailed both pre and post-operational checklist to assure safe and efficient transfer to and from the vessel/barge and the terminal.**
 - In many ways it is a second check on what the ship/barge and terminal have already carried out under their individual checklists. However, it notes important procedural information such as when notice of readiness was given, when the vessel docked, when pumping started and stopped, when inspector started and completed his work, when the vessel or barge had lines off and when he departed the dock.

Methanol Industry Improvements

- **The Future**

- Continuous Safety Improvements
- No more open hatches on vessels as well as barges
- No more wall washes unless absolutely required
- New or improved test methods to support the reduction and eventual elimination of wall wash testing
- Improved and documented cleaning methods for prior cargos before loading methanol
- Improved loss control
- Improved sampling techniques using closed loop sampling process
- Improved design of vapor recovery and vapor destruction system
- Moving the industry to a totally closed system to eliminate most emissions
- Improved tank designs to reduce emissions

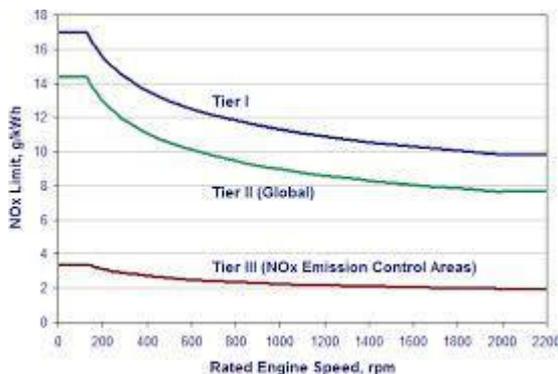
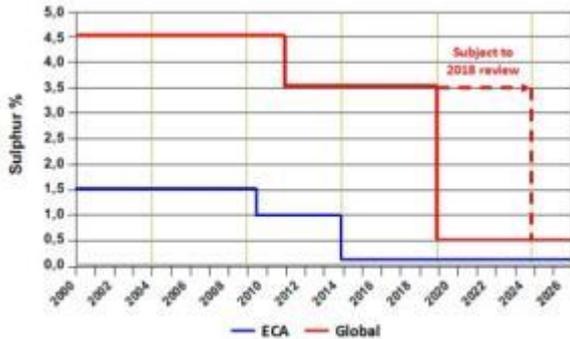


Marine Fuels in Transition

- Bunker fuel – usually made from diesel has been historically used in the shipping industry.
- With over 90,000 commercial vessels moving around the world's oceans, shipping consumes 370 million tons of fuel (Heavy Fuel Oil and Middle Distillates).
- Bunker fuel has been highly polluting; high SO_x, NO_x, particulate emissions.



SOx and NOx Regulations Driving Market

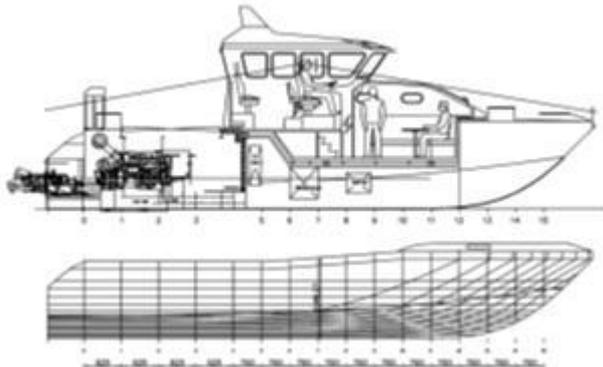
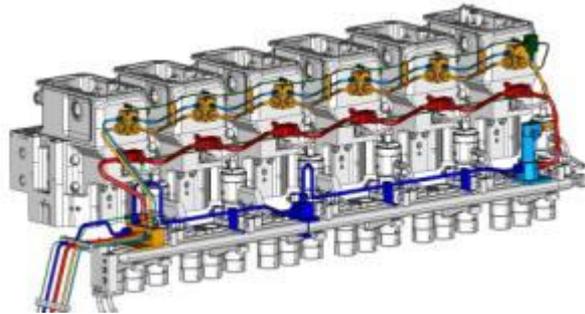


- The International Maritime Organization has adopted regulations for SOx and NOx that are transforming the shipping industry.
- While SOx reductions may be met with low sulfur fuels, the combination of SOx and NOx reductions driving shipboard solutions.
- Current ECA's in North America and Northern Europe, with potential expansion of ECA's into other important shipping hubs.

Methanol Marine Fuels



- Launched in March 2015, *Stena Germanica* features Wärtsilä methanol-fueled marine engine in EU-sponsored effort.
- Methanex's Waterfront Shipping has ordered seven new vessels with MAN dual-fuel methanol/diesel engines.
- MethaShip project led by Lloyd's Register with German shipbuilder and shipyard designing cruise ship and ro-pax ferry over next three years.
- MI sponsoring 2016 Pilot Boat conversion by ScandiNAOS and Swedish Maritime Administration; and Road Ferry conversion with Scania supported by Sweden and Finland.
- MI features Marine Fuels Workshop at European Methanol Policy Forum in Brussels in October.



Methanol Bunker Solution



- In Gothenburg, a bunker station was set up on the pier with two methanol fuel transfer pumps each with the capacity of 200 m³/h that pump methanol from tanker truck to ship *Germanica* bunker.
- This “modular” approach can serve several vessels, and grow with demand.
- Cost is €5 million vs. an LNG terminal costing €50 million.

Methanol vs. LNG

• Methanol

- Capital costs for ship conversion 1/3 that of LNG.
- Methanol can easily be stored at any port in the world, again at a fraction of the cost of LNG storage.
- Major engine manufacturers confident engines can meet SOx and NOx requirements.

• LNG

- 50-60 ships already use LNG as a fuel, while methanol is a cargo.
- LNG industry has head start in promoting the fuel for marine engine use.
- Medium speed LNG dual fuel engines can meet SOx/NOx requirements, but slow speed engines cannot meet NOx, and will need SCR or EGR.



MI Report: *Methanol as a Marine Fuel*

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METHANOL AS A MARINE FUEL REPORT

Sponsored by



- Methanol Institute commissioned a report by FCBI Energy on “*Methanol as a Marine Fuel*”
- Report authored by Prof. Karin Andersson of Sweden’s Chalmers University
- A webinar being organized around upcoming release of the report
- Explores drivers for methanol marine fuels, current technology developments, CAPEX and OPEX

Thank you for your kind attention!



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