

# MB05. RESPOND TO EMERGENCIES

BASIC KNOWLEDGE OF EMERGENCY  
PROCEDURES, INCLUDING EMERGENCY  
SHUTDOWN

# Plan of the lecture

- 1. DRILLS AND EMERGENCY EXERCISES  
(general requirements)**
- 2. Emergency procedures and requirements**

# DRILLS AND EMERGENCY EXERCISES

- Drills and emergency exercises on board shall be conducted at regular intervals.
- Such gas-related exercises could include for example:
  1. tabletop exercise
  2. review of fuelling procedures based in the fuel handling manual
  3. responses to potential contingences
  4. tests of equipment intended for contingency response, like water spray
  5. reviews that assigned seafarers are trained to perform assigned duties during fuelling and contingency response

# EMERGENCY PROCEDURES/REQUIREMENTS

(cont.1/5)

## EMERGENCY PLAN

The plan should be directed at achieving the following aims:

- Rescuing and treating casualties
- Safeguarding others
- Minimizing damage to property and the environment
- Bringing the incident under control

# EMERGENCY PROCEDURES/REQUIREMENTS

(cont.2/5)

## ALARM PROCEDURES

1. Fire-fighting plans and muster lists should be prominently displayed and sign by all personnel
2. Guide in case of LNG fire should cover the following:
  - Raise the fire alarm
  - Assess the fire's source
  - Implement suitable emergency plan
  - Stop the spread of the fire by isolating the source of fuel
  - Cool down surfaces under radiation or flame with water
  - Extinguish the fire with appropriate equipment

# FIRE AND EMERGENCY BREAKAWAY

- All cargo operations must be stopped
- Emergency signals must be sounded as agreed
- All ship's personnel should be removed from manifold area
- Detailed ship and shore emergency procedures will be started
- From ashore ESD2 system will be activated
- Ship/Shore IMO water spray system will be activated in case of fire
- Fire parties will attempt to start commence firefighting actions
- Vessel must depart from the berth with pilot/tugs or other support
- All interested parties should be informed

# EMERGENCY SHUTDOWN (ESD) SYSTEM

(cont.1/3)

- ESD (Emergency Shutdown System)
- Requirement of the IMO code and recommendation of SIGTTO
- ESD is fitted to protect the ship and the terminal in the event of cryogenic or fire risk, on the ship or at the terminal
- ESD system is fitted to shut down the pumps, gas compressors, manifold and ship-side valves to stop the flow of LNG and vapor

# EMERGENCY SHUTDOWN (ESD) SYSTEM

(cont.2/3)

THE GUIDING RULES FOR LIMITING PRESSURE SURGE ON LOADING OR DISCHARGING ARE:

- (1) To stop the cargo pump
- (2) First close the ESD valve nearest to the pump
- (3) Finally, close other ESD valves



# EMERGENCY SHUTDOWN (ESD) SYSTEM

(cont.3/3)

ESDS may be split into various groups:

- 1.ESD system at the manifold area
- 2.ESD system at the cargo tanks
- 3.ESD system at the gas heater
- 4.ESD in Cargo machinery room
- 5.ESD in Electric motor room

# LNG JETTISON (cont.1/3)

1. Jettisoning of cargo from particular cargo tank to the sea
2. Carried out via single main cargo pump and portable jettisoning nozzle

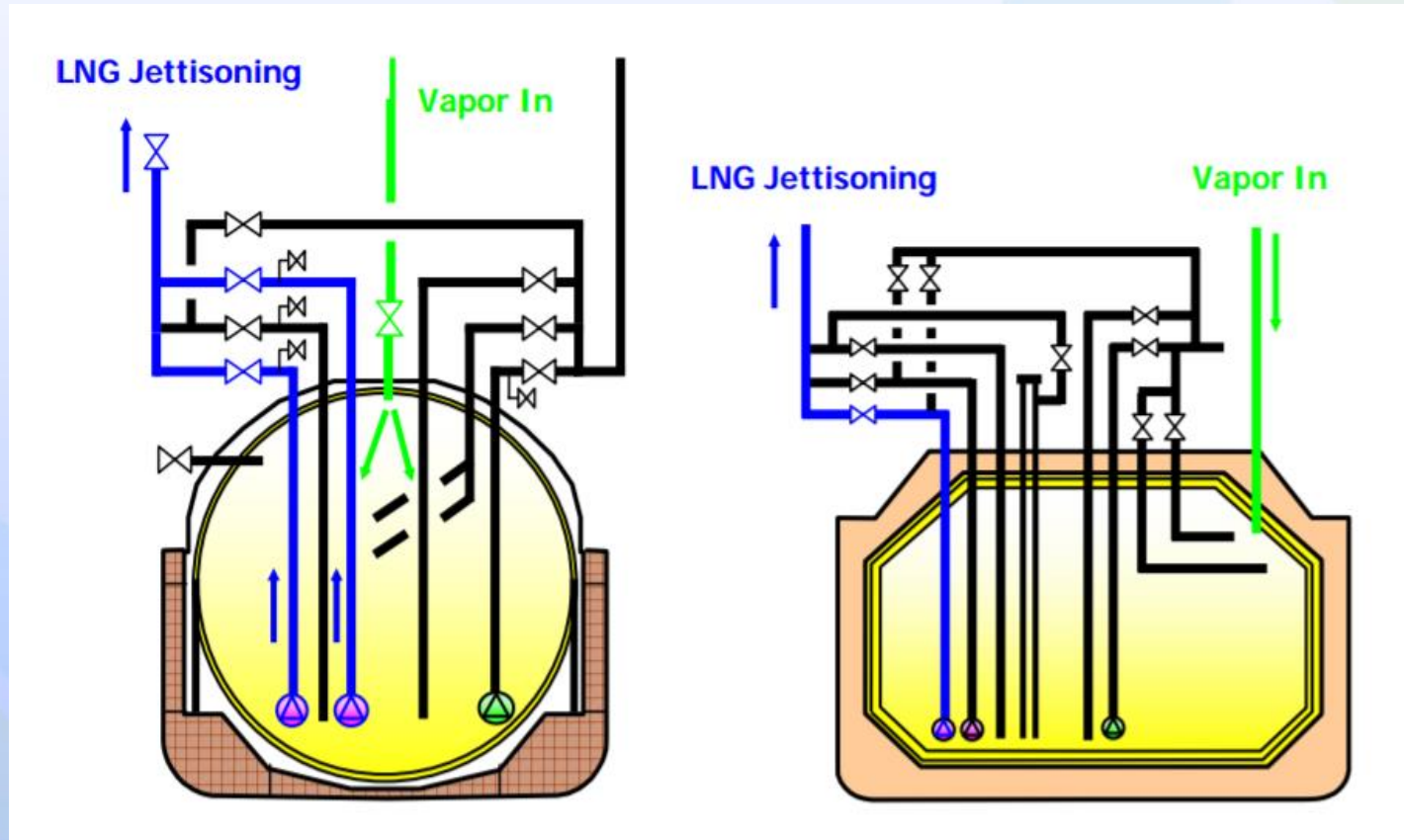
# LNG JETTISON (cont.2/3)

## BEFORE JETTISONING:

- 1.Full investigation of failure
- 2.Firefighting equipment must be placed on scene
- 3.All openings and vent fans must be secured
- 4.No smoking regulations fully in force
- 5.Water curtain on

# LNG JETTISON (cont.3/3)

Emergency jettisoning operation for spherical (left) and membrane (right) type cargo containment systems



*[Source: Comparison of Spherical and Membrane Large LNG Carriers in Terms of Cargo Handling, Kiho Moon, Hyundai Industrial Research Institute, Gastech 2005]*

# LNG VAPOUR LEAKAGE TO BARRIER

(cont.1/5)

- IBS and IS barrier spaces continuously swept with  $N_2$
- Detection of vapor leakage by gas sampling analyzer

# LNG VAPOUR LEAKAGE TO BARRIER

(cont.2/5)

## POSSIBLE LEAKAGE INDICATORS:

1. A sudden rise in the percentage of methane vapor in one primary insulation space
2. Steady increase of vapor concentration when fracture is below the liquid level
3. Fluctuating increase of concentration when the fracture is above the liquid level

# LNG VAPOUR LEAKAGE TO BARRIER

(cont.3/5)

## LEAKAGE OF METHANE VAPOUR-DETERMINING THE RISK

Maintain continuous record all pressure changes occurring in the cargo tank and primary insulation space and additionally:

1.No change of flow of  $N_2$  to the primary insulation space > record hourly for 8 hrs: gas concentration and temperature

2.Adjust  $N_2$  to maintain gas concentration below 30% (vol) > record every 4 hrs: gas concentration and temperature

# LNG LIQUID LEAKAGE TO BARRIER

(cont.4/5)

## LNG LIQUID LEAKAGE TO PRIMARY BARRIER (MEMBRANE) indicators:

- 1.A rapid increase in the methane content of the affected space
- 2.A rise in pressure in the primary insulation space
- 3.Low temperature alarms at all temperature sensors
- 4.A general lowering of inner hull steel temperatures

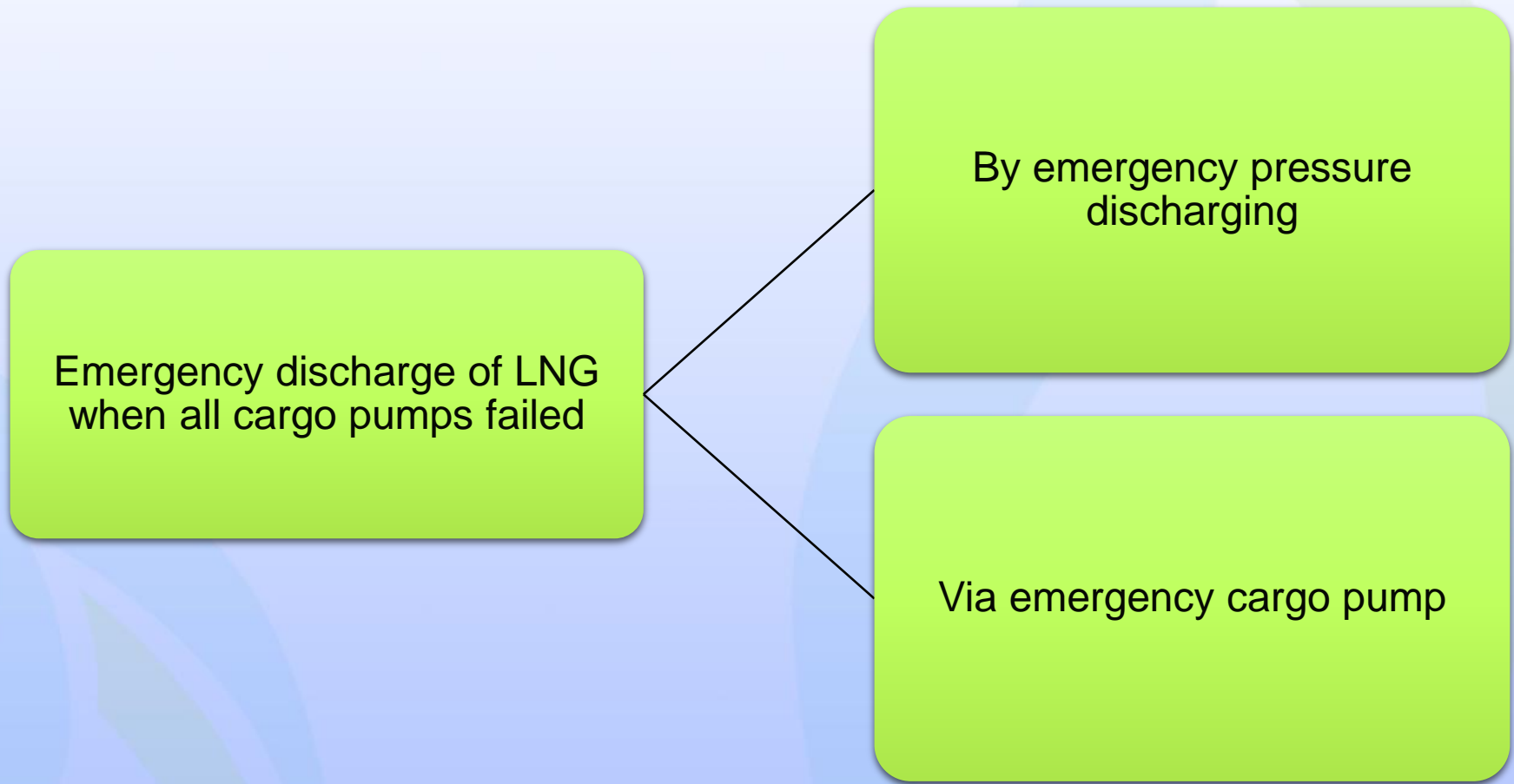


# WATER LEAKAGE TO BARRIER (cont.5/5)

- The pressure differential caused by the head of water building up in the insulation space may be sufficient to deform or even collapse the membrane into the cargo tank
- Each cargo insulation space is provided with water detection units
- A bilge piping system is used for the removal of any water

# FAILURE OF CARGO/BUNKER PUMPS

(cont.1/4)

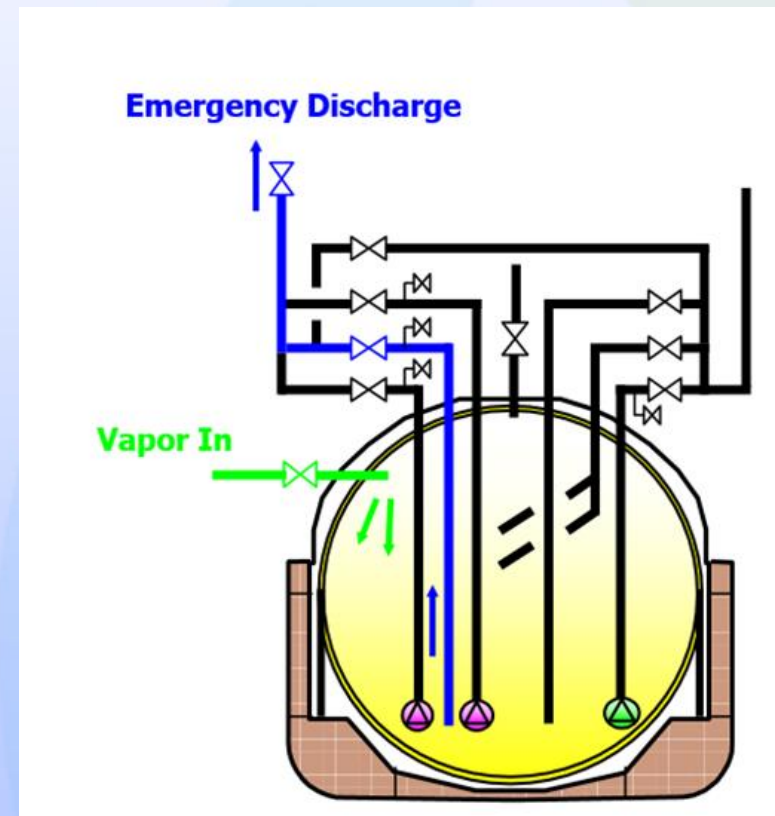


# FAILURE OF CARGO/BUNKER PUMPS (cont.2/4)

## EMERGENCY PRESSURE DISCHARGE:

1. Possible on spherical LNGC
2. LNG transfer to other tanks in normal condition
3. Vapor returns from a combined high-duty heater and vaporizer
4. Control stability of the vessel by ballast operations

Emergency discharge operation for spherical type cargo containment system



[Source: Comparison of Spherical and Membrane Large LNG Carriers in Terms of Cargo Handling, Kiho Moon, Hyundai Industrial Research Institute, Gastech 2005]

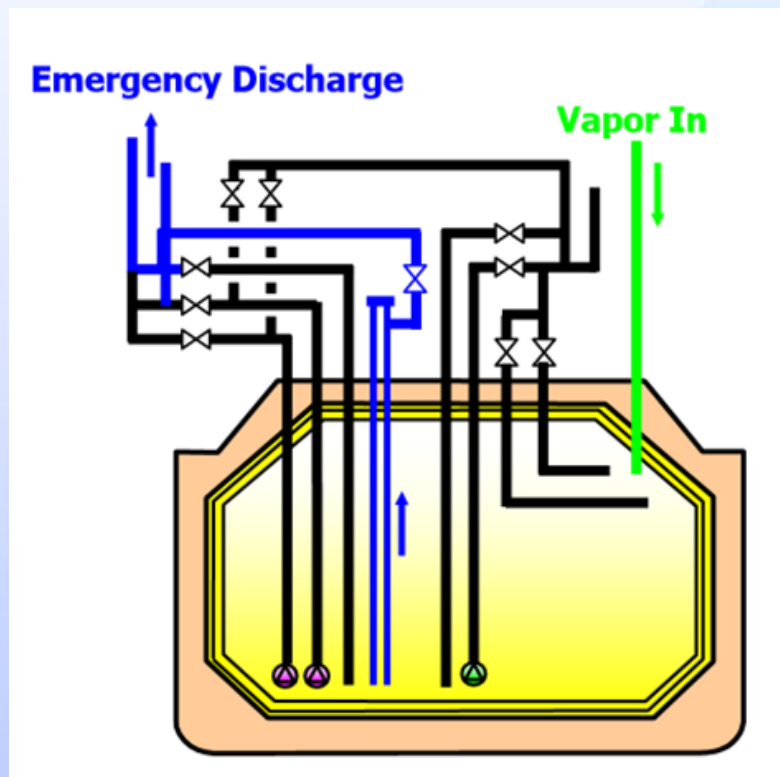
# FAILURE OF CARGO/BUNKER PUMPS<sub>(cont.3/4)</sub>

## **EMERGENCY DISCHARGE VIA EMERGENCY CARGO PUMP:**

- Emergency Cargo pump is used when both main cargo pumps have failed in cargo tank, highly unlikely event
- Emergency pump can be used to empty the cargo pump storage tank so that the main cargo pumps can be removed and serviced
- The Pump is lowered via emergency Cargo pump column for the tank
- The Pump is lowered by specially adopted (usually 2.5 tonnes SWL) derrick
- The procedure for this will be found in the ships specific cargo manual
- The ships superintendent must be kept informed at all times when this procedure is necessitated

# FAILURE OF CARGO/BUNKER PUMPS (cont.4/4)

Emergency discharge operation for membrane type cargo containment system



*[Source: Comparison of Spherical and Membrane Large LNG Carriers in Terms of Cargo Handling, Kiho Moon, Hyundai Industrial Research Institute, Gastech 2005]*

# SHIP TO SHIP (STS) TRANSFER (cont.1/3)

SHIP-TO-SHIP (STS): IT IS THE TRANSFER OF LNG FROM ONE VESSEL OR BARGE, WITH LNG AS CARGO, TO ANOTHER VESSEL

STS operations alongside



*[source: Lng world news, Sept 5th, 2016]*

# SHIP TO SHIP (STS) TRANSFER (cont.2/3)

## STS OPERATIONS CAN BE PERFORMED:

- at the port
- at sea

STS operations at sea



*[source: Lng world news, Jan 7th, 2016]*

# SHIP TO SHIP (STS) TRANSFER (cont.3/3)

- Special consideration for emergency actions in case of spillage or fire
- The various contingencies and emergency procedures should be fully discussed between the two shipmasters before operations commence
- Preferable for the ships to separate in order to minimize the overall risk and to allow unobstructed access to the stricken ship by fire tugs and salvage services