Lesson Topic 3.1

CLEANING AND GAS FREEING



INTRODUCTION

As Gas Free Engineering Personnel you will be expected to know the various methods available to clean tanks and requirements to make them gas free.

Lesson Topic 3.1, Cleaning and Gas Freeing

ENABLING OBJECTIVES

Describe the procedures, equipment and personnel safety precautions used with the Butterworthing method, Chemical cleaning, Steam Cleaning, and Hot or Cold washing in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering, NSTM Chapter 631 Vol. 2, **Preservation of Ships in Service - Surface Preparation and Painting, Manual for Cargo Tank Cleaning and OPNAVINST 5100.19, series.**

Lesson Topic 3.1, Cleaning and Gas Freeing

ENABLING OBJECTIVES

Describe the cleaning process, testing, safety precautions and procedures required for entry into DFM/F-76, CHT, JP-5, and Gasoline tanks, in accordance with NSTM Chapter 074 Vol. 3, Gas Free Engineering, NSTM Chapter 631 Vol. 2, **Preservation of Ships in Service - Surface Preparation and Painting, NSTM Chapter 541, Ship Fuel and Fuel Systems and OPNAVINST** 5100.19, series.

Tank Cleaning

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Tank Cleaning Requirements

- Maintenance cleaning
- Tank inspection or minor repair
- Shipyard overhaul or major repair
- Change of cargo
- After a contaminated cargo
- **Preparation for loading**
- **Preparation for ballasting**
- Activation and inactivation of vessel

Tank Cleaning

 Only properly equipped ships like oilers will clean such spaces as a matter of normal routine.

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Gas Free Engineer responsibilities

Initial testing and evaluation of the space.
Prescribing conditions of entry for cleaning.

NOTE: The GFE will know the various cleaning methods for any given circumstance, in order to evaluate any hazard that may develop during or after cleaning.

Tank Cleaning

Gas Free Engineer responsibilities

- Issuance of a provisional certificate
- **Specifying conditions during cleaning**
- Testing and evaluation of the space after cleaning.
- Collaboration, when necessary, with cleaning personnel.







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- Inspecting personnel
 - Proper clothing
 - Proper equipment

NOTE: The safety observer should have a list of the equipment to be allowed into the space.

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- Inspecting personnel
 - Proper clothing
 - Proper equipment

NOTE: The safety observer should have a list of the equipment to be allowed into the space.

- Not intoxicated or on drugs

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Common hazards

- Use caution when entering or leaving tanks to avoid are slipping or falling, low overheads, and electrical shock.

Physical hazards can be avoided by

- Proper instruction of personnel
- Good judgement
- Constant alertness

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Tank Cleaning

Safety equipment

Tending lines

- Prevent lines and hoses from becoming tangled.
- Do not pull on hoses
- Do not climb on pipes

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Tank Cleaning

Safety equipment

Provide sufficient lighting

- Explosive proof
- Cables should be tied up
- Scaffolding
- Ladders with non-skid tips
- Safety nets, belts

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Safety precautions

Ensure that NO:

- STEAM is admitted to tank with personnel inside
- HIGH PRESSURE WATER is directed through manhole with personnel inside.



Safety precautions

Always be aware of potential danger due to the extremely hazardous situation inside a dark fuel tank.



Tank Cleaning Applications

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\Im Selection of method may be governed by:

- Materials available
- The product involved (cleaning agent)
- Time allotted
- Tank condition

Chemical cleaning

- Effective when used in conjunction with the Wheeler method.
- Suitable method of employing chemicals will be governed by:
 - Type of cleaning
 - Equipment available
 - Time allotted

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Chemical cleaning

Regardless of the method, all personnel shall be thoroughly indoctrinated in safe handling of:

- Chemical solvents
- Emulsifiers

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Butterworthing



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Butterworthing

- Requires heated water (or cleaning oil)
 - High pressure (175 PSI)
 - Revolving nozzle
 - Water temperature 165-185°F



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Butterworthing





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Butterworthing

Tank stripped continuously until the bottom is free of



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Tank Cleaning Applications Butterworthing

Water is supplied through specially constructed



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Steam cleaning

Most thorough method of cleaning tanks.

Consists of melting down materials

No set procedure can be established to suit all fuel tanks

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Steam cleaning

Temperature of tank walls during steam cleaning must not be allowed to exceed <u>230°F</u>.

<u>CAUTION:</u> Excessive temperature may cause buckling of walls, warping or cracking of structures, and may also dangerously overheat flammable or combustible materials within boundary spaces.

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Steam cleaning

- Caution must be used when attempting to steam clean tanks.
- Tanks containing gasoline must be steam cleaned.

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Tank Cleaning Applications Water washing

- Method of cleaning using water under pressure
- In most instances, tanks containing hydrocarbons must be thoroughly steamed or treated with cleaning compounds before being washed.



Method of Gas Freeing DFM / F-76 / JP-5 Tanks and CHT systems

- ${\it O}$ Remove manhole cover.
 - If presence of hydrocarbon vapors is suspected, use non-sparking tools.

∂ Test for oxygen deficiency

- Do not enter tank
- Use drop check method







∂ Test for combustible vapors

- Do not enter tank
- Use drop check method







N Test for toxic condition

- Do not enter tank
- Use drop check method





Gas free engineer is responsible for:

- Testing tank every eight hours or as necessary
- Inspecting tanks for cleanliness
- **Ensuring safe atmospheric conditions exist**
- **Certifying tank: Safe for Personnel Safe for Hot Work**

- A heavy blanket of organic sludge can accumulate on the bottom of a tank during routine CHT operations.
 - The underlying layer of sludge generates hazardous gases -- hydrogen sulfide and methane

- Potential hazards exist when personnel are working on, or in, an open tank.
- Enforce safety precautions to ensure that health and well being of personnel are protected.

CHT tank inspection and maintenance requiring tank entry.

<u>NOTE:</u>All procedures for preparing a CHT tank for cleaning must be followed and adhered i.a.w. written procedures

- Safety precautions for personnel prior to tank opening:
 - Wear approved respiratory equipment

- Safety precautions for personnel prior to tank opening:
 - Two people will be outside the tank to:
 - Constantly observe personnel inside
 - Render assistance if required
 - Provide spare respiratory equipment for immediate use

- After opening tank
 - Test the atmosphere of the space
 - **0**²
 - Explosive
 - Toxics



 If the tank is not gas free, repeat the washdown procedures; retest and certify gas free if safe.



- Recertification is made periodically:
 - <u>No more than every eight hours</u> and each time the ship moves or as specified by the GFE.

Ventilation

- Force ventilate continuously
 - taking suction from bottom of tank and discharging directly to weather deck.
- Make one complete air change every three minutes.



- **Before tank entry**
 - Force ventilate for 30 minutes.
 - Clean thoroughly without entering
 - Continue ventilation during washdown
 - Gas Free Engineer tests tank.
 - If conditions are unsafe, continue ventilation and washdown until certified and safe.

- Equipment and clothing worn by personnel for tank entry.
 - Respiratory protection
 - Coveralls (white CHT)
 - **Boots**
 - Gloves
 - Head covering





Gasoline Tanks

- Protective equipment required for tank entry:
 - Respiratory equipment
 - Protective clothing (light-colored material coverall)
 - Acid-resistant boots
 - Acid-resistant gloves

Gasoline Tanks

All spaces into which gasoline vapors issue must be constantly and thoroughly ventilated.

WARNING: BREATHING AIR RICH IN GASOLINE VAPORS CAN CAUSE DEATH.

Gasoline Tanks

No person shall enter a gasoline storage tank for any purpose without obtaining the Commanding Officer's permission each time.

Gasoline Tanks

Procedures for entering a tank certified gas free and safe

- Enter the tank and remove remaining sludge

<u>NOTE:</u> If only one person enters a tank, a safety harness and tending line must be used.

Gasoline Tanks

- After sludge removal and tank cleaning
 - Retest and certify gas free and safe, or unsafe.
 - If unsafe then ventilate and repeat washdown procedures until certified gas free and safe.





Gasoline Tanks

If safe, Work can now continue inside the tank without respiratory equipment with:

- Continuous ventilation
- GFE approval

Gasoline Tanks

The frequency of testing to be performed is stated on the gas free certificate.

WARNING: No welding or hot work shall be performed on the tank until the Gas Free Engineer certifies the tank is safe for hot work.

REVIEW AND SUMMARY

Review and Summary

ର Tank Cleaning

- **A Tank Cleaning Applications**
- Nethod of Gas Freeing DFM / F-76 / JP-5 Tanks and CHT systems

ANY QUESTIONS?