

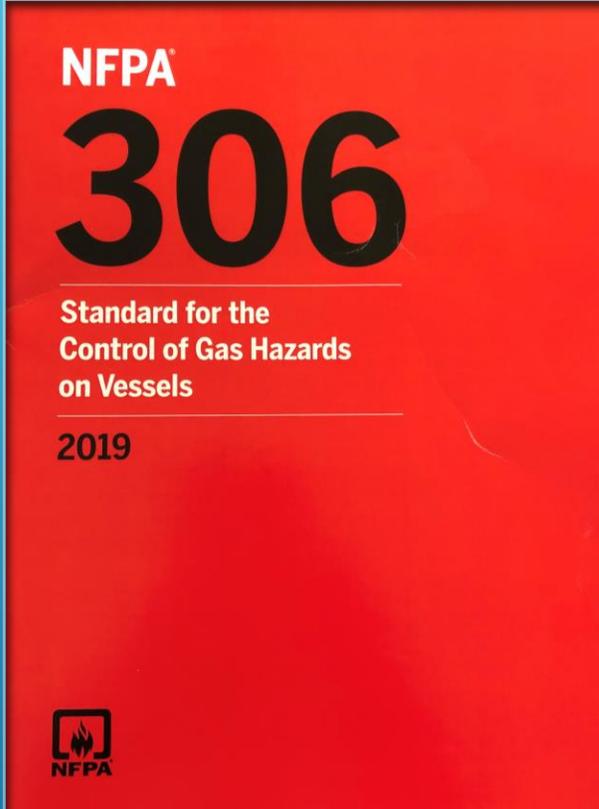
# MARINE CHEMIST: PROTECTING PEOPLE, PRODUCTIVITY, PROPERTY, AND PROFIT

Presented by: Robert R. Rodriguez, CMC #730



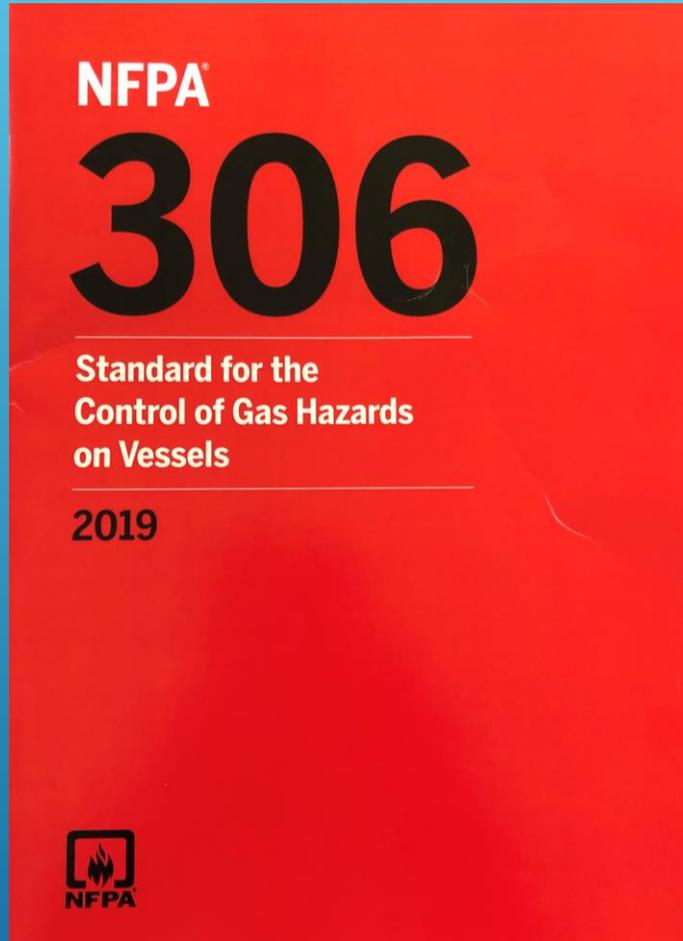
## ROBERT R. RODRIGUEZ, CMC #730

- Marine Chemists of Galveston, LLC
- Special Endorsement for Flammable Cryogenic Liquid Carriers
- University of Houston – Clear Lake Graduate 2014
  - Bachelor of Science Environmental Management



## WHAT IS A NFPA CERTIFICATED MARINE CHEMIST?

NFPA Certificated Marine Chemist (or Marine Chemist) is a trained professional who is responsible for ensuring that repair and construction of marine vessels can be made in safety whenever those repairs might result in fire, explosion, or exposure to toxic vapors or chemicals. By virtue of his or her training, experience, and education, the Marine Chemist is uniquely qualified as a specialist in confined space safety and atmospheric sampling or monitoring.



## DEFINED IN THE STANDARD FOR THE CONTROL OF GAS HAZARDS ON VESSELS, NFPA 306 AS:

“The holder of a valid Certificate issued by the National Fire Protection Association in accordance with the “Rules for the Certification and Recertification of Marine Chemists,” establishing the holder as a person qualified to determine whether construction, alteration, repair, lay-up, or shipbreaking of vessels can be undertaken with safety.”

# BRIEF HISTORY OF MARINE CHEMIST INDUSTRY

- In the US, combustible/flammable liquids have been transported on marine vessels since we became a nation.
- Throughout our history, our shipping industry has experienced its share of accidents related to the transportation of such dangerous cargoes.
- Following WWI, US flagged vessels transported large quantities of combustible and flammable products in bulk, as dangerous cargo and fuel carrying capacity increased on vessels, so did the risk of fire and explosion during repairs in shipyards.
- There was a concern shown by the tanker industry and supported by the (insurance) underwriters, a concern to protect their investments and reduce their liabilities.
- At the time, NFPA was the preeminent body concerned with safety from fire and explosion and it generated all the fire safety standards which the insurance industry employed in its business.
- 1922, the original standard was developed by the NFPA Committee on Marine Fire Hazards in cooperation with the NFPA Committee on Flammable Liquids

# BRIEF HISTORY OF MARINE CHEMIST INDUSTRY CONT...

- 1922 – The first 25 Marine Chemist were certified by American Bureau of Shipping (ABS)
- 1947 – NFPA adopted the Standard for the Control of Gas Hazards on Vessels (NFPA 306)
- 1959 – Dept. of Labor and USCG express concern about shipyard safety
- 1970 – OSHA Act passed, Safety Standards for Shipyard Employment enacted (29 CFR 1915)
- 1982 – Marine Chemist training curriculum is published
- 1988 – NFPA 306 is completely revised
- 1994 – OSHA 29 CFR 1915 Subparts A (General Provisions) & B (Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment) are revised
- 2005 – OSHA creates Fire Protection in Shipyard Employment, 29 CFR 1915 Subpart P
- 2019 – NFPA 306 edition revised to align more accurately with USCG and OSHA regulations that affect waterfront facilities, shipyards, and facilities engaged in shipyard employment

# HOW MANY ACTIVE MARINE CHEMIST?

- **Breakdown**
    - 1 Female Marine Chemist
    - 96 Male Marine Chemist
  - **Atlantic Coast Section**
    - Includes – Maine, Massachusetts, New Hampshire, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Virginia, North Carolina, South Carolina, Florida, Puerto Rico, U.S. Virgin Islands
  - **Gulf-Inland Section (Inland Waters)**
    - Includes – Illinois, Kentucky, Tennessee
  - **Gulf-Inland Section (Gulf Coast)**
    - Includes – Alabama, Mississippi, Louisiana, Texas
  - **Pacific Coast Section**
    - Includes – California, Oregon, Washington, Alaska, Hawaii, Guam, Japan, Philippines
- 

Jeff Zile, CMC #700



Amy Liu, CMC #706



## WHY DOES THE MARITIME INDUSTRY NEED MARINE CHEMISTS?

- A crude oil tanker has discharged its cargo, cleaned its tanks, and is in shipyard for hot work repairs to its cargo tanks: How can workers be sure that the vessel is safe for repair?
- Workers in a shipyard prepare to enter the tank of a tank barge that has recently off-loaded its cargo of benzene: How can they be certain there are no residual crude oil vapor or no traces of benzene remaining in the “empty” cargo tanks?
- A USCG Marine Inspector needs to inspect a cargo compressor room on a liquefied petroleum gas (LPG) tanker: How can the USCG Marine Inspector be sure there is no toxic or flammable gas in the compressor room?
- A marine surveyor from the American Bureau of Shipping (ABS) needs to inspect the damage to a ballast tank that is adjacent to an inerted cargo tank: How can the marine survey inspector be sure that the ballast tank is not oxygen deficient?
- A National Cargo Bureau inspector needs to search for insects in a cargo hold that has been fumigated and will carry grain on its next voyage: How can the agricultural inspector have confidence that the atmosphere in the grain hold is safe to breathe?



## HOT WORK

- Many bulk liquid cargoes (currently on the vessel or previously carried on the vessel) and certain work procedures present higher degrees of hazard
- “Hot Work”, which is any fire-producing or spark-producing operation that produces temperatures high enough to act as a source of ignition to a flammable vapor mixture, for example, always carries some risk of fire and explosion



# WHO REQUIRES A MARINE CHEMIST TO BE USED?



## U.S. Coast Guard Regulations

- 46 CFR 35.01-1(c)(1) – **Subchapter D, Tank Vessels**
- 46 CFR 71.60 -1 (c)(1) – **Subchapter H, Passenger Vessels**
- 46 CFR 91.50 - 1 (c)(1) – **Subchapter I, Cargo & Misc Vessels**
- 46 CFR 109.573 – **Subchapter I-A, Mobile Offshore Drilling Units (MODU)**
- 46 CFR 115.710 (b)(1) – **Subchapter K, Small Passenger Vessels (> 150 passengers or overnight > 49 passengers)**
- 46 CFR 126.160 (c)(1) – **Subchapter L, Offshore Supply Vessels**
- 46 CFR 146.665 (a)(1) – **Subchapter M, Towing Vessels**
- 46 CFR 167.30-10 (c)(1) – **Subchapter R, Nautical Schools**
- 46 CFR 176.710 (b)(1) – **Subchapter T, Small Passenger Vessels (<100 gross tons)**
- 46 CFR 189.50-1 (c)(1) – **Subchapter U, Oceanographic Research Vessels**



## WHO REQUIRES A MARINE CHEMIST TO BE USED?

### Occupational Safety and Health Administration (OSHA)

- **Title 29 Code of Federal Regulations**
  - **§1915.14 – Hot Work**
    - (a) Hot work requiring testing by a Marine Chemist or Coast Guard authorized person.

- In complying with both USCG/OSHA Regulations, the Marine Chemist applies the requirements contained in National Fire Protection Association's *Standard for the Control of Gas Hazards on Vessels*, NFPA 306.
- The Standard (our “Bible”) describes conditions that must exist in confined spaces and areas aboard a marine vessel where the potential for hazardous oxygen concentration, accumulation of combustible gas and/or toxic vapor exist before the work can be done.
- The survey by the Marine Chemist verifies conditions necessary to carry out the work, are satisfied BEFORE THE WORK IS STARTED.
- The work of the Marine Chemist combined with maritime regulations and standards comprise a practical and effective systems approach to safety of life, limb, and property within the maritime construction and repair industry.

# DUTIES OF THE MARINE CHEMIST

- **Recognition**
  - Responsible for providing recognition of the spaces that present hazards to workers during entry or work. Hazards might result from any number of conditions. Examples: difficult entry or egress, unnatural ventilation, and/or the actual or potential presence of atmospheric contaminants.
  - Spaces most likely to present hazards include: Engine Room & Machinery Spaces, Bilges, Pump Rooms, Fuel & Cargo Tanks, Ballast Tanks, Cofferdams, Wing or Void Tanks
  - Confined spaces can be deficient in oxygen, they can contain flammable or toxic contaminants, residual liquid, solid residues or scale that has the capacity of regenerating hazardous conditions.

# DUTIES OF THE MARINE CHEMIST

- **Evaluation**

- Involves the real-time monitoring of the confined space to determine the atmospheric level of oxygen, flammable vapors, and toxics within the spaces. The Marine Chemist compares the results of monitoring and measuring with the guidelines provided in NFPA 306, USCG 46 CFR, and OSHA 29 CFR.
- These guidelines are a quantitative analysis of the atmosphere which include:
  - **Oxygen** – standards require at least 19.5% by volume and no more than 22% by volume (Normal air contains 20.8% oxygen by volume which is what we really want)
  - **Flammability** – less than 10% of the lower explosive limit (LEL)
  - **Toxicity** – less than permissible concentrations; that is, either the level set by OSHA called the Permissible Exposure Limit (PEL) or the level set by the American Conference of Governmental Industrial Hygienists (ACGIH), which is called the Threshold Limit Value (TLV), or other published occupational exposure limit
- A qualitative survey (visual inspection) of the confined space where the Marine Chemist looks for residues (cargo or fuel), preservative coatings and/or other potential hazards.

# DUTIES OF THE MARINE CHEMIST

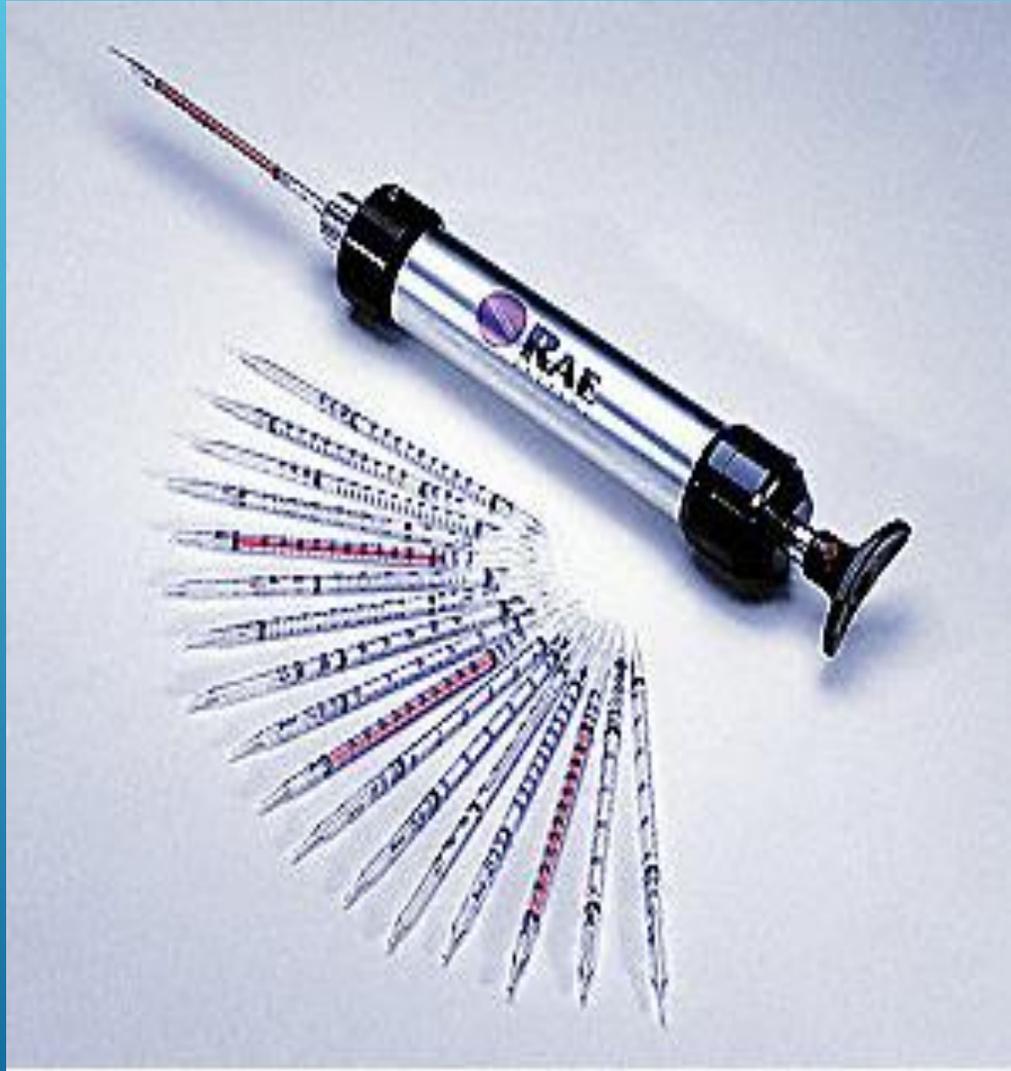
- **Control**

- Any action taken to eliminate or minimize a hazard that has been recognized and evaluated. Control of hazards which have been recognized and evaluated presents great difficulty for the Marine Chemist and the industry as whole. All too often, the cause of confined space accidents has been failure to control to maintain safe working conditions throughout the duration of the prescribed work.
- There are **3 types of Control**:
  - **Engineering** – The most common form of engineering is ventilation
  - **Administrative** – Include training, standard operating procedures or safe work practices, and permit systems that authorize work and entry.
  - **Personal Protection** – Personal Protection Equipment (PPE), considered the last method of choice, because it means the hazard hasn't been removed or eliminated. Instead of making the space safe for the workers, the workers have been made safe for the space.



## TYPES OF EQUIPMENT

- MSA Altair 5x Multi-gas Meter
- Used to detect
  - **O<sub>2</sub>** - Oxygen
  - **CO** - Carbon Monoxide
  - **VOC's** - Volatile Organic Compounds
  - **H<sub>2</sub>S** - Hydrogen Sulfide
  - **LEL** - Lower Explosive Limit
- Sensors can be switched out
- Calibrated before each day's use



## TYPES OF EQUIPMENT

- Colorimetric Gas Detection Tubes and Pump
- Used for rapid detection and measurement of contaminants in air.
- Sealed glass tubes containing an inert solid or granular material such as silica gel, alumina, resin, or ground glass
- Inert material is impregnated with or mixed with one or more reagents which change color when specific types of air contaminants are introduced
- Examples
  - Ammonia
  - Carbon Dioxide
  - Benzene

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## MARINE CHEMIST CERTIFICATE

SERIAL NO. **A** 000551

Marine Chemist's Name: \_\_\_\_\_ (Print)

Marine Chemist's Contact Information: \_\_\_\_\_ (Telephone/Pager/Email) Page \_\_\_\_\_ of \_\_\_\_\_

Survey Requested by: \_\_\_\_\_ Vessel Owner or Agent Date: \_\_\_\_\_

Vessel: \_\_\_\_\_ Type of Vessel: \_\_\_\_\_ Specific Location of Vessel: \_\_\_\_\_

Last Three (3) Loadings: \_\_\_\_\_ Tests Performed: \_\_\_\_\_ Time Survey Completed: \_\_\_\_\_

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In the event of physical or atmospheric changes affecting the STANDARD SAFETY DESIGNATIONS assigned to any of the above spaces, this certificate is voided; spaces not listed on the Certificate are not to be entered unless authorized on another Certificate and/or maintained in accordance with OSHA 29 CFR 1915, or if in any doubt, immediately stop all work and contact the undersigned Marine Chemist. Unless otherwise stated on the Certificate, all spaces and affected adjacent spaces are to be reinspected daily or more often as necessary by the competent person in support of work prior to entry or recommencement of work.

**QUALIFICATIONS:** Transfer of ballast, cargo, fuel, or manipulation of valves or closure equipment tending to alter conditions in pipelines, tanks, or compartments subject to gas accumulation, unless specifically approved on this Certificate, requires inspection and a new Certificate for spaces so affected. All lines, vents, heating coils, valves, and similar enclosed appurtenances shall be considered "hot safe" unless otherwise specifically designated. Movement of the vessel from its specific location voids the Certificate unless shifting of the vessel within the facility has been specifically authorized on this Certificate.

**STANDARD SAFETY DESIGNATIONS:** (partial list, paraphrased from NFPA 306).

**ATMOSPHERE SAFE FOR WORKERS:** In the compartment or space so designated (a) the oxygen content of the atmosphere is at least 19.5 percent and not greater than 22 percent by volume; (b) the concentration of flammable materials is below 10 percent of the lower explosive limit; (c) any toxic materials in the atmosphere associated with cargo, fuel, tank coatings, inerting mediums, or fumigants are within permissible concentrations at the time of the inspection.

**NOT SAFE FOR WORKERS:** In the compartment or space so designated, entry is not permitted.

**ENTER WITH RESTRICTIONS:** In the compartment or space so designated, entry for work is permitted only if conditions of proper protective equipment, or clothing, or time, or all of the aforementioned, as appropriate, are as specified.

**SAFE FOR HOT WORK:** In the compartment or space so designated (a) the oxygen content of the atmosphere is not greater than 22 percent by volume; (b) the concentration of flammable materials in the atmosphere is less than 10 percent of the lower explosive limit; (c) the residues, scale, or preservative coatings are cleaned sufficiently to prevent the spread of fire and are not capable of producing a higher concentration than permitted by (a) or (b); (d) all adjacent spaces, containing or having contained flammable or combustible materials shall be sufficiently cleaned of residues, scale, or preservative coatings to prevent the spread of fire, or they are inerted. Ship's fuel tanks, lube tanks, or engine room or fire room bilges, or other machinery spaces, are treated in accordance with the Marine Chemist's requirements.

**SAFE FOR LIMITED HOT WORK:** In the compartment or space so designated (a) portions of the space meet the requirements for Safe for Hot Work and Partial Cleaning, as applicable, or (b) the space is inerted, adjacent spaces meet the requirements for Safe for Hot Work, and hot work is restricted to specific locations; (c) portions of the space shall meet the requirements for Safe for Hot Work, as applicable, and the nature or type of hot work is limited or restricted.

**NOT SAFE FOR HOT WORK:** In the compartment or space so designated, hot work is not permitted.

**CHEMISTS ENDORSEMENT:** This is to certify that I have personally determined that all spaces in the foregoing list are in accordance with NFPA 306 Control of Gas Hazards on Vessels and have found the condition of each to be in accordance with its assigned designation.

\*The undersigned acknowledges receipt of this Certificate under NFPA 306 and understands conditions and limitations under which it was issued, and the requirements for maintaining its validity.

This Certificate is based on conditions existing at the time the inspection herein set forth was completed and is issued subject to compliance with all qualifications and instructions.

Signed \_\_\_\_\_ Company \_\_\_\_\_ Date \_\_\_\_\_ Signed \_\_\_\_\_ Certificate No. \_\_\_\_\_  
Marine Chemist

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# MARINE CHEMIST CERTIFICATE

- When the Marine Chemist is satisfied that the related requirements necessary for the safe conduct of the work have or have not been met, a Marine Chemist's Certificate is prepared in accordance with NFPA 306
- Essential that the cert is written legibly, includes the instrument test results for all spaces tested including adjacent spaces

# MARINE CHEMIST CERTIFICATE

- Any additional requirements or qualifications necessary for the work to be performed safely must be specified on the Certificate, such as:
  - The frequency and type of such additional tests, inspections and qualifications.
  - Other instructions to maintain safe conditions throughout the duration of the work, such as the need for a fire watch.
  - Conditions under which the Marine Chemist shall be consulted or recalled.
  - Protective equipment and devices necessary to eliminate or minimize hazards that could be present from combustibles, protective coatings, or residues from cargoes.

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## MARINE CHEMIST CERTIFICATE

SERIAL NO. **A** 000551

Marine Chemist's Name: \_\_\_\_\_ (Print)  
Marine Chemist's Contact Information: \_\_\_\_\_ (Telephone/Pager/Email) Page \_\_\_\_\_ of \_\_\_\_\_

Survey Requested by: \_\_\_\_\_ Vessel Owner or Agent Date: \_\_\_\_\_  
Vessel: \_\_\_\_\_ Type of Vessel: \_\_\_\_\_ Specific Location of Vessel: \_\_\_\_\_  
Last Three (3) Loadings: \_\_\_\_\_ Tests Performed: \_\_\_\_\_ Time Survey Completed: \_\_\_\_\_

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**QUALIFICATIONS:** Transfer of ballast, cargo, fuel, or manipulation of valves or closure equipment tending to alter conditions in pipelines, tanks, or compartments subject to gas accumulation, unless specifically approved on this Certificate, requires inspection and a new Certificate for spaces so affected. All lines, vents, heating coils, valves, and similar enclosed appurtenances shall be considered "hot safe" unless otherwise specifically designated. Movement of the vessel from its specific location voids the Certificate unless shifting of the vessel within the facility has been specifically authorized on this Certificate.

**STANDARD SAFETY DESIGNATIONS:** (partial list, paraphrased from NFPA 306).

**ATMOSPHERE SAFE FOR WORKERS:** In the compartment or space so designated (a) the oxygen content of the atmosphere is at least 19.5 percent and not greater than 22 percent by volume; (b) the concentration of flammable materials is below 10 percent of the lower explosive limit; (c) any toxic materials in the atmosphere associated with cargo, fuel, tank coatings, inerting mediums, or fumigants are within permissible concentrations at the time of the inspection.

**NOT SAFE FOR WORKERS:** In the compartment or space so designated, entry is not permitted.

**ENTER WITH RESTRICTIONS:** In the compartment or space so designated, entry for work is permitted only if conditions of proper protective equipment, or clothing, or time, or all of the aforementioned, as appropriate, are as specified.

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**CHEMISTS ENDORSEMENT:** This is to certify that I have personally determined that all spaces in the foregoing list are in accordance with its assigned designation. Hazards on Vessels and have found the condition of each to be in accordance with its assigned designation.

\*The undersigned acknowledges receipt of this Certificate under NFPA 306 and understands conditions and situations under which it was issued, and the requirements for maintaining its validity.

This Certificate is based on conditions existing at the time the inspection herein set forth was completed and is issued subject to compliance with all qualifications and instructions.

Signed \_\_\_\_\_ Company \_\_\_\_\_ Date \_\_\_\_\_ Signed \_\_\_\_\_ Certificate No. \_\_\_\_\_  
Marine Chemist

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# NFPA 306 “STANDARD SAFETY DESIGNATIONS”

- Atmosphere Safe For Workers
  - Enter With Restrictions
  - Not Safe For Workers
  - Safe For Hot Work
  - Safe For Limited Hot Work
  - Not Safe For Hot Work
  - Inerted
  - Inerted For Flammable Compressed Gas
  - Safe For Shipbreaking
  - Safe For Lay-up
- 

# LOST PROPERTY



# FATALITIES

Three Seafarers Dead in Confined Space Accident



The Apollo Kita (file image via social media)

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Three crewmembers of the timber carrier *Apollo Kita* died Friday while working in one of the vessel's holds. The suspected cause of death was asphyxiation.

While the *Kita* was under way off Ishigakijima, bound for Osaka with a load of wood, the three crewmembers entered the hold and became unconscious. They were flown to a hospital in Ishigaki for treatment, but they did not recover. Authorities in Ishigaki believe that the oxygen level in the hold may have fallen too low, causing the men to lose consciousness.

Man killed after tank explosion in Kemah

By JOHN WAYNE FERGUSON The Daily News Jul 23, 2018

KEMAH

A man was killed Monday morning after he was caught in an explosion at his company in Kemah.

Billy Woolsey, 57, was killed in the explosion, his son confirmed on Monday afternoon. Woolsey was the owner of Gulf Coast Trawl Doors, a welding and fabrication company on Lawrence Road.

The explosion happened around 9:30 a.m. aboard a small boat at the company's property. Woolsey was welding a gas tank on the boat before the explosion, according to the Galveston County Sheriff's Office.

Woolsey suffered severe burns because of the explosion, according to the sheriff's office. He was taken to Clear Lake Regional Medical Center in Webster, where he was pronounced dead.

The sheriff's office does not suspect foul play. The Occupational Safety and Health Administration will also conduct its own investigation into the explosion and death,

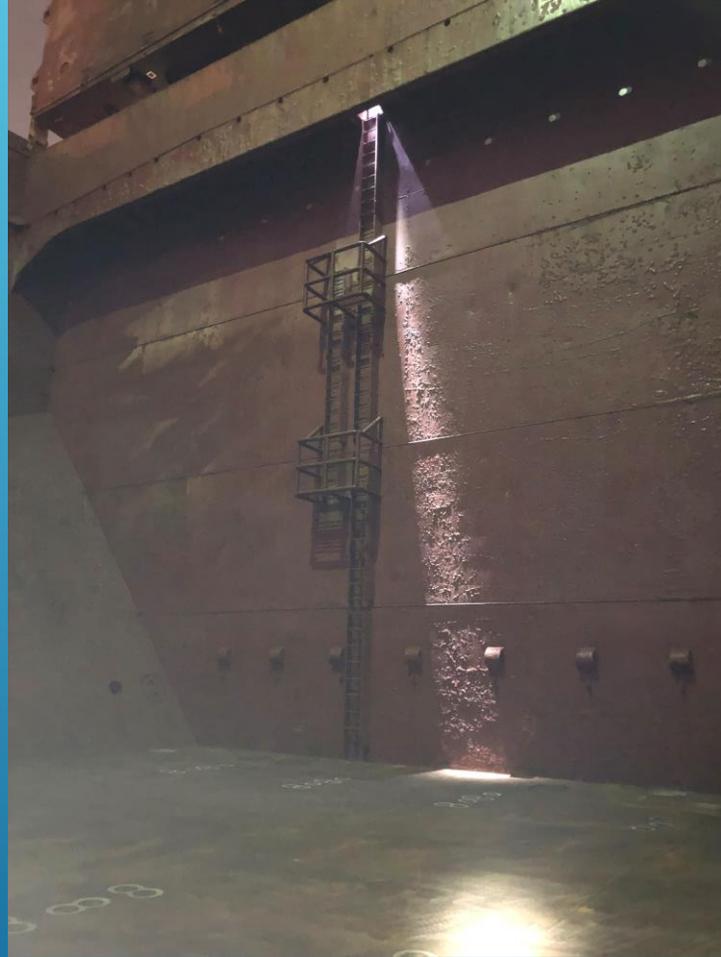
Most Popular

- 1. Teens told
- 2. Weekend
- 3. Man accus woman
- 4. Two killed identified
- 5. Ownership Kemah ea
- 6. Aldi opens mainland
- 7. Newcome incumben
- 8. Commissi manager
- 9. Medical bo off
- 10. College of referendu

# PROTECTING PROPERTY









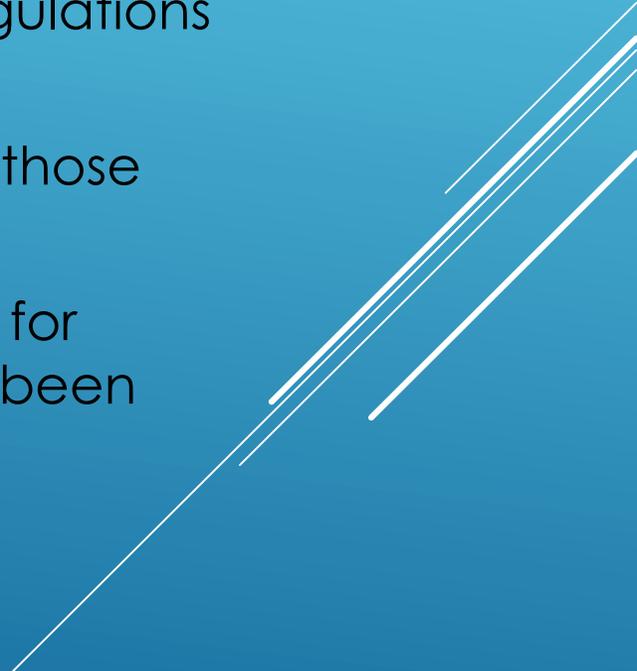
# HOW TO BECOME A MARINE CHEMIST

- Register as a Marine Chemist Trainee & be accepted by the Marine Chemist Qualification Board.
- While a Trainee, shall have completed at least 6 months of supervised training in all tests and inspections required prior to the issuance of a MC certificate.
- At least 3 Marine Chemists shall directly supervise this training. Each shall supervise at least 40hrs of the applicant's shipboard training.
- In addition, each applicant shall have completed at least 3 years experience, as follows:
  - 1yr or more full-time employment in the analysis of physical samples similar to those routinely analyzed by MC. This employment is to be a laboratory or other similar work environment acceptable to the Board.

# HOW TO BECOME A MARINE CHEMIST

- The remaining time, but not less than 1 yr, must be in full-time employment in marine construction or repair, or in another marine industrial environment acceptable to the Board.
- Each Trainee, shall have not less than 300hrs of supervised training aboard a variety of types of both ocean-going and inland vessels.
- Applicant shall have at least a Bachelor's Degree from a college or university accredited by an accrediting agency recognized by the Secretary of Education of the United States.
- College level courses must be taken with passing grade:
  - 2 semesters or 3 qtrs. of general inorganic chemistry w/labs
  - 2 semesters or 3 qtrs. of organic chemistry w/labs
  - 1 semester or 2 qtrs. of analytical chemistry w/lab, including instrumental analysis
  - 1 course in industrial hygiene sampling and analysis

# HOW TO BECOME A MARINE CHEMIST

- Applicant shall satisfactorily complete the then current approved Marine Chemist training curriculum (18 modules).
  - Each Applicant shall complete to the Board's satisfaction an examination on the Standard and applicable United States Coast Guard (USCG) and OSHA regulations, and other technically related or appropriate standards, rules, or regulations considered necessary by the Board.
  - A personal thesis outlining the Applicant's knowledge of those items as assigned by the Board.
  - Applicant shall have a personal interview with the Board for "Initial Certification" once all Trainee requirements have been completed and approved by the Board.
- 

## THE BOTTOM LINE...

- The maritime industry trusts the NFPA Certificated Marine Chemist to verify safe conditions for work and prescribe requirements necessary to maintain those safe conditions throughout the duration of the work.
  - The safety and health of shipyard workers, repair contractors, tank cleaners, vessel crew members, marine surveyors, marine inspectors and USCG personnel depend on the work done by the Marine Chemist.
  - Vessel owners and shipyard employers rely on the Marine Chemist to protect their personnel from dangerous atmospheres and protect their property from fires and explosions.
- 



Thank you and don't  
forget...Safety First!

Marine Chemists of Galveston, LLC

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