

NFPA Certificated Marine Chemists – A Century of Fire Protection and Life Safety

By Lawrence B. Russell and Guy R. Colonna, P.E.

As the NFPA Technical Committee vote on the First Draft of the 2024 edition of NFPA 306, *Standard for the Control of Gas Hazards on Vessels*, the National Fire Protection Association will mark 100 years of the NFPA Certificated Marine Chemist Program and its advocacy of fire protection and life safety on marine vessels, in shipyards, marine terminals and waterfront facilities.

What started a century ago as an industry effort to prevent fires on vessels under repair has never been more important. According to a 2007 report of the U.S. Bureau of Labor Statistics, approximately 25 percent of fatalities in shipyards result from fires and explosions caused by hot work. Hot work incidents also cause injuries to personnel and property damage or loss.

OSHA defines hot work as: welding, cutting, burning, abrasive blasting, and other heat-producing operations. Hot work presents an increased risk of fire and explosion on marine vessels and in shipyards because it is often performed in or adjacent to confined and enclosed spaces that contained combustible or flammable liquids or gases.



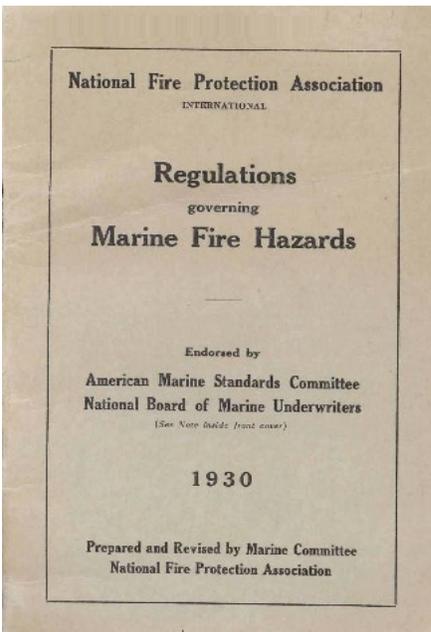
NFPA Photo

Following the First World War, merchant vessels were being converted from troop transport vessels to their original purpose as bulk carriers and cargo vessels. Inadequate safety precautions and insufficient cleaning resulted in numerous fires or explosions. Vessel owners, shipyards and marine insurers all recognized that something had to change. Marine industry representatives including the American Bureau of Shipping (ABS) asked NFPA for assistance in the development of a fire prevention standard specific to the hazards found on marine vessels while being repaired in shipyards.

At the 1922 Annual Meeting of the National Fire Protection Association, Mr. S. D. McComb of the National Board of Marine Underwriters and Chairman of NFPA's Marine Committee presented the American Bureau of Shipping's, *Regulations Governing Marine Fire Hazards*. As Mr. McComb said, the regulations "...intended to point out the principal hazards on shipboard and the best way to control them". The hazard he was

referring to in, *Appendix "A", Having to Do with the Freeing of Tanks of Flammable and Explosive Vapors Previous to Making Repairs*, was fire.

One example of the severity of the hazards Mr. McComb was referring to is the explosion and fire that destroyed the Norwegian-flagged oil tanker, *SS Mantilla*, on November 19, 1926, that was in a drydock at the Bethlehem Shipbuilding Company, in Sparrows Point, MD. The explosion ripped through the vessel, killing fifteen shipyard workers and seamen, and injuring 70 more. As reported in newspapers at the time, the explosion was caused by the ignition of flammable vapor that was generated from oil that remained in a fuel tank when the ship went into the drydock.



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With incidents like that happening all too frequently, it did not take long for these new *Regulations* to be adopted. At the 1931 annual meeting of the NFPA, Mr. McComb reported that many oil companies and underwriters in the United States, Canada, and abroad had subscribed to or adopted these fire prevention requirements. In 1949 the standard was given the document number 306. In 1951 the title for NFPA 306 was changed to the *Standards for the Control of Gas Hazards on Vessels to be Repaired*.

From the beginning the unique feature of the *Regulations* was the requirement for the tanks that were the subject of hot work to be tested and inspected by a certified competent chemist whose ability and reliability was attested to by the ABS.

The first 25 chemists were certified in 1922. These chemists were for the most part employed in the laboratories of petroleum refineries. So, they understood the properties and characteristics of the petroleum products that were carried as fuel and cargo on marine vessels.

The ABS certified the, "gas chemists", for the next 41 years. Then in 1963, following several months of discussion and negotiation with the representatives of the industries involved in marine transportation, particularly vessel operators and the shipbuilding industries, the NFPA agreed to assume full responsibility for marine chemist training and certification. To accomplish this mission the NFPA established the Marine Field Service to provide stronger industry leadership in the prevention of fire and related hazards on vessels and in shipyards. The Marine Field Service is comprised of two principal groups: the Marine Field Service Advisory Committee and the Marine Chemist Qualification Board. The members of these groups are appointed by the NFPA Board of Directors

The Marine Field Service Advisory Committee assists the president of the Association in the administration of the Marine Field Service; and facilitates communication among the sponsoring elements of the maritime industry and the management of NFPA. The Committee consults with the president in the selection and appointment of staff personnel assigned to the Marine Field Service. It reviews and approves the Marine Field Service's annual budget. It also advises the president on budget administration and receives periodic budget reports pertaining to the Marine Field Service from NFPA. The members of the Marine Field Service Advisory Committee come from various maritime industry associations including American Bureau of Shipping, American Petroleum Institute, American Waterways Operators, Marine Chemist Association, Marine Insurance Underwriters, Shipbuilders Council of America, and the U. S. Chamber of Shipping.

The Marine Chemist Qualification Board (MCQB) is comprised of representatives from the marine insurance industry; tank vessel operators; shipbuilding or vessel repair industry; Marine Chemist Association; a practicing Marine Chemist; Occupational Safety and Health Administration (OSHA); U.S. Coast Guard and U.S. Navy. The term of office for the commercial industry voting members representatives is three-years. These members can serve two consecutive terms. Federal agency members may be voting or non-voting participants and have no term limitations.

The MCQB is responsible for establishing the *Rules for the Certification and Recertification of Marine Chemists* that are adopted by the Board of Directors. The MCQB acts on applications for certification and recertification of marine chemists and the registration of trainees. The MCQB also reviews accident reports that involve marine chemists and when necessary, takes disciplinary action which can include the suspension, cancellation, or the revocation of a marine chemist's qualification documents.

Marine Chemists must have a combination of academic knowledge and professional expertise. Applicants for certification as a marine chemist must have a bachelor's degree and complete specific coursework in chemistry and industrial hygiene; and they

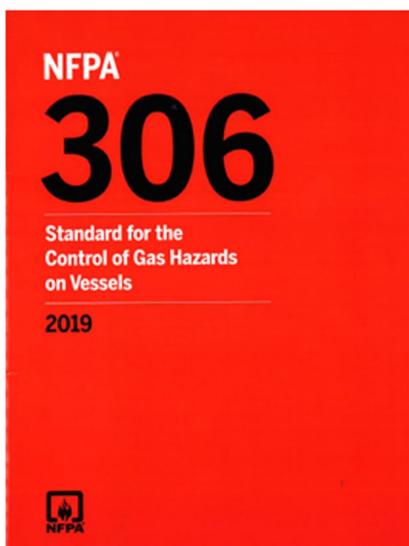
must satisfactorily complete learning modules that are focused on the marine chemist's profession. A minimum of three-years of practical work experience is also required. Such work can be within a shipyard or other marine professions such as a licensed merchant mariner, Navy or Coast Guard service, or employment in a laboratory. Each marine chemist trainee must complete 500-hours of field work with at least three marine



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chemists. A trainee is required to write a thesis on a subject related to the marine chemist profession and then he or she must be interviewed by the MCQB.

The qualification documents that identify an individual as an NFPA Certificated Marine Chemist are valid for a period of five-years. To be eligible for recertification a marine chemist must be examined by a licensed medical professional and determined to be physically capable of doing the job. Marine chemists are required to attend professional development training seminars, pass a written examination, and have their work activity reviewed by the MCQB. Marine Field Service personnel periodically observe marine chemists while the chemists are conducting tests and inspections; and then report those observations to the MCQB.



NFPA 306 – NFPA Photo

NFPA 306 is the document that a marine chemist is required to use when he or she performs activities related to inspection and certification procedures described in the standard. The standard applies to vessels that carry or burn as fuel, flammable or combustible liquids, flammable compressed gases, flammable cryogenic liquids, chemicals in bulk, or other products capable of creating a hazardous condition. It provides minimum requirements and conditions that are necessary before a space can be entered or before work can be started, continued, or started and continued on any vessel under construction, alteration, or repair, or on any vessel awaiting shipbreaking.

The standard also applies to land-side confined spaces such as: storage tanks, hollow structures, tank trucks, railroad tank cars, fuel tanks, laundry tanks, vaults, and tunnels that are located within the boundaries of a marine terminal, shipyard or waterfront facility.

The requirements of the current edition of NFPA 306 can be traced back to 1922 and Appendix A of the *Regulations Governing Marine Fire Hazards*. Marine chemists are required to identify the hazards that are on board the vessel in the tanks or compartments where the work is to occur and the adjacent spaces. These can include oxygen deficiency, flammable gas or toxic vapor associated with cargo or fuel products, or combustible materials that may be present at the time of the inspection.

The chemist is required to quantitatively and qualitatively determine the severity of the hazards that are present. Once that has been done, the marine chemist then prescribes the control measures that are necessary to make the space safe for the intended repair. Those controls can include additional cleaning, ventilation, or use of fire protective barriers. If the space is suitable for the intended work the marine chemist may provide

additional instructions to protect the workers and maintain safe conditions during the course of the repair work. Such precautions may include periodic retesting of the atmosphere, maintaining ventilation, the use of a fire watch or prescribing protective clothing or equipment including respirators.

Finally, once the marine chemist's determinations are completed, he or she will issue a Marine Chemist's Certificate that documents the results of the survey, the standard safety designations for the spaces that were inspected, and the conditions that are necessary to maintain safe conditions for work. The Certificate is then signed by the marine chemist and the certificate requester who is then responsible for maintaining the safe conditions documented on the Certificate in accordance with NFPA 306. The signed Certificate must be posted on the vessel before the work can commence.



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The regulations of both OSHA (29 CFR 1915, Shipyard Employment) and the Coast Guard (46 CFR, Shipping) require a Marine Chemist's Certificate is posted for hot work in, on or adjacent to tanks, spaces or compartments that contain or previously contained combustible or flammable liquids or flammable gas. It is essentially a permit to work, or a document that prohibits work if the marine chemist finds conditions are not safe. Failure to follow the requirements of NFPA 306 and the applicable regulations can have catastrophic consequences.

For example, on January 19, 2018, an explosion occurred on a towing vessel that was being repaired in a Kentucky shipyard. Three workers were killed, and two others were critically injured. The explosion happened as workers were performing hot work in an atmosphere that contained a dangerous concentration of flammable gas. There was no Marine Chemist's Certificate posted on the towing vessel prior to the commencement of the repair work. OSHA cited the shipyard, and four repair contractor companies with 55 violations that included:

- Failure to test confined spaces before entry,
- Failure to train workers on confined space entry operations,
- Allowing hot work to be performed without testing for an explosive atmosphere,
- Failure to label chemical containers, and
- Exposing employees to asphyxiation, fire, explosion, chemical, trip, and drowning hazards.

Presently there are 93 NFPA Certificated Marine Chemists located in ports throughout the continental United States, Hawaii, Alaska, and Guam. Together these marine

chemists write about 31,000 Marine Chemist's Certificates each year. There are 24 marine chemist trainees registered with the NFPA.

Marine industry stakeholders along with OSHA, the U. S. Coast Guard and U. S. Navy are essential participants in the NFPA Certificated Marine Chemist Program. These stakeholders also participate on NFPA technical committees to develop the standards for life safety and fire protection of vessels, in shipyards, marine terminals, marinas and boatyards. This activity is critical to the success of NFPA's mission to eliminate death, injury, property and economic loss from fire, electrical and related hazards.



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It's fitting that NFPA 306 has entered the revision cycle for the 2024 edition just as the marine chemist program enters its second century. The revision process for NFPA standards allows the requirements within the standard to evolve as changes occur within affected industries. During the last revision cycle in response to the building of vessels fueled with liquefied natural gas (LNG), the Technical Committee on Gas Hazards developed requirements for LNG-fueled vessels. Because marine chemists are increasingly called upon to test and inspect tanks within shipyards, marine terminals, and other waterfront facilities the first draft of the next edition of NFPA 306 will include a new chapter to address inspection requirements for above ground storage tanks. Shipbreaking operations – the process of tearing down obsolete vessels to scrap metal - have increased in recent years in the United States. The Technical Committee developed revisions to strengthen the controls for this activity. The first draft of the next edition of NFPA 306 will be available on the NFPA website for public review and comment on March 22, 2022.

Over the past 100 years NFPA 306 and marine chemists have demonstrated an ability to adapt which remains critical to continued success in protecting workers and work sites. Industry stakeholders have observed first hand that when the standard is followed; and a marine chemist affirms a safe condition exists with an inspection and documentation on a certificate - major incidents rarely occur.

What began as an experiment in the 1920's continues a century later and serves as a testament to a successful industry-and-government partnership. For 100 years the NFPA Certificated Marine Chemist has been the professional who the marine transportation industry and shipyard industry has relied upon for confined space safety and fire prevention on marine vessels, in marine terminals and in shipyards. As we

enter a new century of service to these stakeholders, marine chemists will continue to apply NFPA 306 to assure the safety of workers and to protect shipyards, marine terminals, and waterfront facilities from fire.

If you would like more information about the NFPA Certificated Marine Chemist Program or NFPA 306, *Standard for the Control of Gas Hazards on Vessels*, please go to the NFPA website: www.nfpa.org

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