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Vigilant Eye

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50 YEARS OF NFPA + THE MARINE INDUSTRY
Vigilant Eye
A tiny group of NFPA-certified marine chemists is responsible for overseeing safe work practices aboard thousands of vessels and in scores of shipyards across the United States

Amy Sly, the only woman currently working as a certified marine chemist, crawls past a vessel's impeller to inspect the bow thruster tunnel. (Photo: Don Sly)

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By Lawrence Russell

As the cost to build new ships and barges increases, for both the U.S. Navy and commercial shipping interests, the need to maintain and repair existing vessels becomes even more important. Repair work done on vessels often involves hot work, such as burning, grinding, torch cutting, welding, and other fire-producing activities. Much of that work takes place in proximity to combustible materials — fuel, cargo, wood products, insulation materials, to name a few — and is often conducted in confined or enclosed spaces where the atmosphere can be oxygen-deficient, and can often contain flammable vapor, toxic gases, or fumes.

Making sure the work can be done safely is the job of NFPA-certificated marine chemists. They aren't chemists per se, but their actions safeguard maritime and shipyard workers against a vast array of potentially harmful chemicals and their interactions. Only when a marine chemist has certified an area as safe can entry and work proceed. Both the U.S. Coast Guard and the Occupational Safety and Health Administration (OSHA) require a marine chemist certificate before a range of repair tasks can begin.

Despite the importance of marine chemists to some of the industry's most dangerous locations and tasks, the group is virtually unknown to those outside the maritime transportation, shipbuilding, and vessel repair industries. In part, that's because there are only 93 certificated marine chemists in the country. This tiny group of safety professionals is responsible for overseeing work on thousands of vessels and maritime facilities, part of an industrial base approaching $76 billion annually in the U.S., according to the Industrial College of the Armed Forces.

Marine chemists can be employees of a shipyard or vessel repair facility, work independently, or belong to a group operating under one business name. Chemists are not restricted to a single port; they can cover a large geographic area and can even fly offshore for work on oil and gas drilling and production platforms. Regardless of how and where they're employed, though, marine chemists essentially work on behalf of shipyard employees, the Coast Guard marine inspector, the marine surveyor, and the vessel crewmembers by ensuring that confined spaces meet the requirements of NFPA 306, Control of Gas Hazards on Vessels. Marine chemists collectively write more than 100 certificates a day to verify whether or not confined spaces on maritime vessels and in shipyards are safe for people to enter and do work.

This year marks a number of milestones for marine chemists and their relationship with NFPA. For starters, it is the 50th anniversary of NFPA's decision to become the administrator for the Certificated Marine Chemist Program. It also marks the completion of the 20th revision of NFPA 306, the marine chemist's go-to document. This is also a notable year in the development of NFPA 350, Guide for Safe Confined Space Entry and Work, an important new document that will focus on creating best practices for working in and around confined spaces.

Century in the making

Marine chemists begin the survey process by determining the extent and nature of the work to be performed. Referring to NFPA 306, chemists select the testing instruments to be used during the survey, including atmospheric monitors, colorimetric detector tubes, and other sampling devices necessary to determine the amount of oxygen, flammable gas, and toxic vapors within a confined space. If the atmosphere inside the confined space permits safe entry, the chemist then makes a visual inspection of the space, during which samples of cargo, fuel, residues, or other substances can be taken for analysis of their flammable or toxic properties. Results of the survey, along with any requirements or instructions for maintaining safe conditions throughout the period of work, are recorded on the marine chemist's certificate, a serialized document that must be posted in the vicinity of the work before it can begin, in accordance with NFPA 306, as well as OSHA and U.S. Coast Guard regulations. It is then the responsibility of the shipyard or vessel repairer to maintain the safe conditions documented on the certificate.

If the atmosphere or conditions of an area are not safe to permit work, the chemist will declare the space "not safe for workers" and/or "not safe for hot work," and then prescribe what needs to be done to properly prepare the space for safe entry and work. For example, a tank may need additional cleaning or improved ventilation, or combustible material may need to be removed from a space or shielded by protective barriers. Once these steps are completed, the marine chemist will resurvey the space, verify that safe conditions exist, and issue a certificate permitting work to proceed.

FEATURE SIDEBARS

Fast, Flexible, Responsive
Technology provides new tools for marine chemists, and more convenience for industry.

Scenes from the Field
Marine chemists at work — and the kinds of incidents they try to prevent.

The procedures used by marine chemists originated nearly a century ago. Following the First World War, as cargo vessels, particularly tank ships, were being converted to carry larger cargo parcels on longer voyages, the incident rate of fires and explosions during shipbuilding, repair, and conversion began to rise. Vessel owners, shipyard owners, and their insurance underwriters became increasingly concerned over the fire and explosion hazards associated with shipyard employment, and NFPA shared their concern. In 1922, NFPA's Marine Committee adopted a series of standards known as the Regulations Governing Marine Fire Hazards. Appendix A of those regulations addressed the control of gas hazards on vessels during repair activities, and would eventually become NFPA 306.

With the adoption of these requirements, the maritime industry needed people with specific technical knowledge and skills who could ensure that these fire prevention requirements were followed. The American Bureau of Shipping (ABS), which establishes and maintains minimum standards for construction and operation of ship and offshore structures, already had a cooperative relationship between ship owners and shipyards, and it agreed to initiate procedures for certifying specialists (then called gas chemists) who would use and essentially enforce the standard on a daily basis. The first 25 gas chemists were certified by ABS in 1922. This arrangement worked for a while, but it was an activity that was outside the ABS mission. By the early 1960s, ABS was seeking a successor to manage the program.

That's when NFPA stepped in. NFPA's Charles S. Morgan, who would later become president of the association, said the marine industry needed to find an organization that had "sufficient independence, integrity, and recognition" to pick up the work from ABS. As Morgan noted, "There weren't many organizations around that could fill the bill." NFPA could, though, and at Morgan's urging the NFPA Marine Field Service was created in 1963 to manage the Marine Chemist Program. In time, certification and recertification criteria were revised, and a Marine Chemist Qualification Board was created to serve as an

oversight body and take advantage of new technologies (see “Fast, Flexible, Responsive,” facing page) to make the certification process more effective.

The new NFPA 306, the newer NFPA 350
During the current revision of NFPA 306, the Technical Committee on Gas Hazards determined that the arrangement of the requirements did not accurately reflect the actual work process that is involved when a maritime vessel goes from normal operating status to the point where a marine chemist’s certificate is obtained and repair work can begin. Requirements were scattered throughout the document, making it confusing to follow for anyone who didn’t use it regularly. With this pending new revision, however, users should be better able to understand the process of when a marine chemist is required, how to prepare a vessel for a chemist’s tests and inspection, and what to expect during the survey.

The 2014 edition will also include provisions that address the evolution of the marine chemist’s various roles during the ship repair process. Over the years, marine chemists have become recognized experts in fire prevention during vessel repairs, which has led to repair contractors requesting their services or consultation for areas and spaces in a vessel where chemists are not necessarily required by either OSHA or U.S. Coast Guard regulations. Those consultations can include tests and inspections in accommodation areas, storage spaces, and auxiliary equipment rooms. In addition, the Technical Committee on Gas Hazards has established new criteria for evaluating spaces adjacent to hot work and how frequently a space must be checked after a certificate has been posted. The changes stress the importance of maintaining safe work conditions within confined spaces and are intended to provide minimum re-inspection and testing requirements to achieve this objective.

The expanded new edition of NFPA 306 coincides with the development of a brand-new best-practices document, NFPA 350. Dangerous atmospheric conditions and other physical hazards associated with confined spaces are not unique to shipyards and the maritime industry, of course, and every year as many as 100 people perish in confined spaces found in mills, granaries, chemical plants, refineries, public utilities, construction sites, farms, and a variety of other workplaces around the United States.

That’s why NFPA’s Standards Council in 2007 approved the creation of the Technical Committee on Confined Spaces and charged it with developing a document to address confined space hazards. NFPA 350 will be prescriptive rather than performance-based, providing guidance on how to perform tasks such as gas monitoring and ventilation, and will include training recommendations and competencies for those working in confined spaces. The objective is to translate existing regulatory language into practical approaches that can be understood and implemented at all levels of the affected workplaces. The idea is to create a document that goes beyond minimum regulations and requirements to provide the best work practices that should be used for all confined space entries, regardless of type.

The committee has met twice, most recently in January. At the initial meeting, in September, a representative of the U.S. Chemical Safety and Hazard Investigation Board (CSB) gave a presentation that identified causal factors common to confined space accidents, such as hot work, as well as gaps in current regulations that the CSB would like to see addressed, such as atmospheric testing and hazard identification in adjacent spaces. Committee task groups developing draft chapters for NFPA 350 have focused on identification and evaluation of confined space hazards, gas monitoring, ventilation, rescue, training competencies, eliminating and controlling hazards, permits, and prevention through design. The plan is to have a draft ready for the Standards Council to approve at its meeting in August. NFPA 350 will then be entered into the Fall 2015 revision cycle.

OSHA regulations and many of the standards and codes that address confined spaces provide only minimum requirements for safe confined space entry. Most are performance-based and do not provide prescriptive information on how to apply the regulations. NFPA 350 will provide best practices that will enable a company’s safety officers and workers to go beyond the minimum standards to ensure safe entry, work, and exit from confined spaces.

Lawrence Russell is senior specialist, chemical, and administers the NFPA Marine Chemist Program. Nancy Pearce, a senior engineer at NFPA, contributed to this article.

SIDEBAR
Fast, Flexible, Responsive
Technology provides new tools for marine chemists, and more convenience for industry

NFPA’s Marine Field Service reflects the partnership that NFPA has forged with the marine industry and the government, one with a shared goal of eliminating confined space accidents and fires on vessels during shipbuilding and repair.

In fact, neither the Marine Field Service nor the Marine Chemist Program would exist without the support of the marine industry. When NFPA’s Marine Field Service was created in 1963, marine industry stakeholders agreed that those who use the services of marine chemists should contribute to the costs of NFPA’s certification program in proportion to their use. A surcharge for every survey completed by a marine chemist is paid into a fund administered by the Marine Gas Hazards Control Program (MGHCP), which is comprised of representatives from the American Bureau of Shipping, the American Petroleum Institute, the American Waterways Operators, the Chamber of Shipping of America, and the Shipbuilders Council of America. The MGHCP fund supports marine chemist training programs and other efforts to improve the program such as the Electronic Marine Chemist’s Certificate (EMCC).

In October 2009, the MGHCP, which has long supported some type of electronic marine chemist certificate asked NFPA to create and administer a computer-based certificate-writing program that met the needs of marine chemists as well as those of the shipbuilding and vessel repair industry. A Marine Field Service task group was established, and its recommendations became the foundation of a new computer-generated EMCC. Over the next two years, the NFPA Marine Field Service and NFPA’s Information Services department conducted trials with marine chemists across the country. In October, 2011, the EMCC program was unveiled.

The response from marine chemists, shipyards, and Coast Guard marine inspectors has been very positive. The new EMCC provides unprecedented flexibility and convenience for both the marine chemist and the marine industry. Using MGHCP-purchased laptop computers and compact wireless printers, marine chemists can generate high-quality, standardized, and legible certificates onboard any vessel. The computers also serve as a ready resource tool for chemists with files that include NFPA standards and hazardous chemical references such as the NIOSH Pocket Guide to Chemical Hazards and the Coast Guard's Chemical Hazard Response Information System (CHRIS).

When using the EMCC program, marine chemists have at their fingertips a checklist of all the mandatory elements found in NFPA 306. The program includes alert features that prevent marine chemists from issuing a certificate with information that is contrary to the standard's requirements, and yet gives them the flexibility to write detailed instructions particular to a specific vessel and job.

Because the EMCC is a fully functional electronic document, the marine chemist and the vessel representative can sign the completed certificate form on the computer, just like signing for credit card purchases. The completed electronic certificate is saved in PDF form, which helps recipients comply with OSHA recordkeeping regulations. As of this writing, 40 percent of marine chemists have the EMCC, and the Marine Field Service will be distributing more units to other chemists this year.

For more information on the EMCC program, contact Lawrence Russell at lrussell@nfpa.org.

— L.R.

SIDEBAR
Scenes from the Field
Marine chemists at work — and the kinds of incidents they try to prevent

Barge explosion
March 25, 2010
Ingleside, Texas

Two workers were attempting to make a minor repair to a vent riser on the expansion dome above a cargo tank on a barge. Contrary to regulations established by both the Occupational Safety and Health Administration and the U.S. Coast Guard, the repairer did not call for a marine chemist to test and inspect the barge and then post a marine chemist's certificate on the barge before the hot work repair began.

As the workers were finishing a weld to a pipe collar, crude oil vapor from the residue of three previous cargoes was apparently ignited by welding sparks. One of the workers reported hearing a rumbling sound that was followed by a massive explosion. A witness in a passing tug boat stated that the blast was so strong that it blew out the windows in the pilot's house of his boat. The two workers suffered only minor injuries, though one was thrown into the waterway and had to be rescued by a passing vessel. Both were treated at a local hospital and released. The barge was declared a total constructive loss.

Had a marine chemist been consulted, the work would not have occurred until the barge was in a safe condition, which could have been accomplished by either washing and gas-freeing the tanks or employing the use of inert gas to prevent the risk of explosion and fire.

Carbon monoxide exposure
May 17, 2012
Seattle, Washington

A worker was assigned the task of cleaning the hold of a fishing vessel, and brought a pressure washer powered by an internal combustion engine into the hold. As the worker was cleaning the hold, carbon monoxide (CO) quickly accumulated in the poorly ventilated space. The worker was not immediately aware that he was being poisoned, because CO is an odorless and colorless gas. At some point he did recognize he was in trouble and managed to exit the hold, only to collapse on the deck. He was revived by paramedics, but died en route to the hospital.

Work activity of this type does not require a marine chemist's certificate. However, OSHA directs an employer to designate a "competent person," someone capable of recognizing and evaluating workplace hazards or unsafe conditions and is capable of taking action to ensure the safety of employees. When internal combustion engines on portable equipment exhaust into an atmosphere below decks, such as a fish hold, the competent person is required to test for CO in the atmosphere to verify that dangerous concentrations do not develop. If the concentration of CO exceeds the OSHA permissible limit (PEL) of 50 ppm (0.005% by volume), then workers need to be evacuated from the space or area until safe conditions are reestablished.

Carbon monoxide incident
May 30, 2012
Tacoma, WA

Thirteen days after the fatal CO accident in Seattle, a marine chemist was called to a large factory trawler in a shipyard to inspect and certify a repair involving hot work in the trawler's engine room. As the marine chemist was preparing for the inspection, he noticed workers were prepping the exterior deck for a new coating of paint. To protect the work area, the workers had erected a tent-like structure to keep the area dry during inclement weather.

As the marine chemist finished checking his equipment for the job in the engine room, he heard an internal combustion engine starting and being warmed up for work. He immediately headed up the gangway to find a worker using a gasoline-powered "rust-buster" to de-scale the deck. The machine had been running for two or three minutes. The marine chemist's CO detector indicated a concentration of 150 ppm, well above the recommended levels. The marine chemist shut down the operation and

provided instruction to the workers about the hazards of using gasoline-powered machines and the need for proper ventilation in an enclosed space. Only after safe conditions were established did the work resume.

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