MEMORANDUM

TO: All Marine Chemists, Marine Chemist Trainees

FROM: Lawrence B. Russell, Principal Specialist, NFPA Marine Field Service

DATE: 11 December 2020

SUBJECT: NTSB Safer Seas Digest 2019 and Discussion About Hot Work Involving Tween Deck Pontoons

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The National Transportation Safety Board (NTSB) has released its "*Safer Seas Digest 2019: Lessons Learned from Marine Accident Investigations*." The digest provides a summary of 30 marine accidents, the investigative findings of which were issued or adopted in 2019. These accidents involved contact with fixed objects, breakaways, sinkings, collisions, fires, floodings, groundings, and other vessel damage. The vessels ranged from personal craft to oceangoing passenger ships and a US Navy vessel. The NTSB publication can be viewed or downloaded from this webpage:
https://www.ntsb.gov/investigations/AccidentReports/Reports/SPC2004.pdf#search=safer%20seas%20digest%202019

Two of the incidents discussed in the NTSB publication concern fire protection during hot work. The NTSB notes: “It is critical to evaluate work areas for fire hazards to ensure that adequate protection is in place. Crewmembers involved in hot work should be trained to identify possible hazards and take action to remove or mitigate these potential risks to the vessel and crew.”

The NTSB also points to an often-cited causal factor in hot work-related fires – an ineffective or non-existent fire watch. As emphasized by the NTSB, a “fire watch should not perform any other duties while acting as fire watch and should remain on-site until the area is deemed to be safe, unless relieved by another crewmember”.

Inadequate fire protection during hot work was a factor in the F/V *Jeanette* accident. Inadequate fire protection during hot work and delayed notification to port authorities when a fire broke out were factors in the M/V *Chipolbrok Moon* cargo hold fire.

The M/V *Chipolbrok Moon* fire was one of three fire incidents that involved hot work sparks and slag falling through gaps separating tween deck pontoons in 2018. The sparks and slag then ignited cargo that was stowed in the lower hold below the hot work location. These incidents were discussed during the presentation of Occurrence Reports at the 2018 Marine Chemist Association Sectional Training Seminars. During the past few years at least one incident of this type has been reported.

Lift-away and pontoon type hatch covers are found on container ships and break-bulk freight ships. These types of hatch covers can be comprised of one or several panels. They can be

opened in an independent order and they allow partial hatch opening. Each panel can be lifted (removed and returned) using the vessel's crane or a shore-side crane. The picture below shows a tween deck pontoon being lifted.

Source: https://www.youtube.com/watch?v=WDJvF-Xi4Jg

Pontoon type hatch covers feature a flat top and flat bottom plate and are weathertight. As shown in the photograph below, hatch covers are hollow structures. In fact, they may be a multi-segmented or sub-divided hollow structure as shown in the picture. To determine if it is safe to perform hot work on a tween deck pontoon it may be necessary to drill a hole and test the atmosphere within the pontoon in several places.

Source: https://www.youtube.com/watch?v=WDJvF-Xi4Jg

Marine Chemists are being asked to provide a Marine Chemist's Certificate to allow ship's crew or a contractor to remove pad-eyes and other temporary fittings used to lash cargo to the tween deck hatch covers on these vessels.

During tests and inspections Marine Chemists have found tween deck pontoons that were explosive (100% LEL). Often there are gaps between the pontoons; and the pontoons and the ship's bulkheads. These gaps need to be covered by a fire protective barrier to prevent sparks and slag from falling onto cargo and or dunnage located below the tween deck. The fire protective barriers should be in place and inspected by the Marine Chemist before the Certificate is completed, signed and posted. It's also necessary for a fire watch to be in the lower hold or other areas where hot work sparks and slag may fall. The fire watch should have with him or her a suitable means for extinguishing any incipient stage fire; and a means of communicating with the person doing the hot work.

These precautionary measures may seem obvious, but apparently they are not because these fires continue to occur. Recently I have learned that some vessel operators or contractors have objected to the fire protection precautions that a Marine Chemist required for this type of hot work. To assist you in your outreach efforts to your customers and or local authority having jurisdiction please find the applicable requirements from NFPA Standards, OSHA and the International Maritime Organization when discussing fire protection methods.

NFPA 306: *Standard for the Control of Gas Hazards on Vessels*, 2019 Edition - Chapter 7 Standard Safety Designations and Conditions Required

7.1.4 The designation SAFE FOR HOT WORK requires that in the compartment or space so designated, the following criteria shall be met at the time the Certificate is issued:

(1) The oxygen content of the atmosphere is not greater than 22 percent by volume.

(2) The concentration of flammable materials in the atmosphere is less than 10 percent of the LEL.

(3) The residues, scale, or soft and greasy preservative coatings in the entire space are cleaned sufficiently to prevent the spread of fire and are not capable of producing a higher concentration than permitted by 7.1.4(1) or 7.1.4(2) under existing atmospheric conditions in the presence of hot work and while maintained as directed on the Certificate.

(4) All spaces adjacent to cargo tanks certified SAFE FOR HOT WORK, as well as all cargo tanks adjacent to a hot work site, have combustible gas readings less than 10 percent of the LEL and have been cleaned sufficiently of residues, scale, or preservative coatings to prevent the spread of fire or have been inerted.

(5) Non-cargo tank spaces, such as vessels' fuel tanks, lube tanks, engine room or fire room bilges, or machinery spaces adjacent to non-cargo spaces certified SAFE FOR HOT WORK are treated in accordance with Marine Chemist requirements and acknowledged on the Certificate.

(6) Spaces such as passageways, living spaces, or store rooms that are not adjacent to cargo tanks and are undergoing hot work meet the requirements of 7.1.4(1) and 7.1.4(2), and they, along with any adjacent spaces, shall be treated in accordance with the Marine Chemist's instructions and shall either be free of material that could ignite under conditions of work or be protected with barriers to prevent the spread of fire.

NFPA 312, *Standard for Fire Protection of Vessels During Construction, Conversion, Repair, and Lay-Up*, 2021 Edition

4.5.2 Fire Watch.

A.4.5.2 The employer should develop a written fire watch policy that specifies the following:

(1) The training required for persons assigned fire watch duties
(2) The duties of the fire watch
(3) The equipment that persons assigned to the fire watch might be expected to use
(4) The personal protective equipment (PPE) required for persons assigned to the fire watch

Additional information regarding fire watch requirements can be found in NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 edition. 29 CFR 1915.504, "Fire Watches," and 29 CFR 1915.508(e), "Additional Training Requirements for Fire Watch Duty."

4.5.2.1 A fire watch shall be posted if during hot work the following can occur:

(1) Slag, weld splatter, or sparks can cause a fire.
(2) Fire-resistant guards or curtains are not used to prevent ignition of combustible materials on or near decks, bulkheads, partitions, or overheads.
(3) Combustible material closer than 35 ft (10.7 m) to the hot work in either the horizontal or vertical direction cannot be removed, protected with flameproof covers, or otherwise shielded with metal or fire-resistant guards or curtains, so that the material is not ignited by the hot work.
(4) On or near insulation, combustible coatings or sandwich-type construction on either side cannot be shielded, cut back or removed, or the space inerted.
(5) Combustible materials adjacent to the opposite sides of bulkheads, decks, overheads, metal partitions, or of sandwich-type construction can be ignited by conduction or radiation.
(6) The hot work is close enough to cause ignition through heat radiation or conduction on the following:
    (a) Insulated pipes, bulkheads, decks, partitions, or overheads
    (b) Combustible materials and/or coatings
(7) The hot work is close enough to unprotected combustible pipe or cable runs to cause ignition.
(8) A person recognized by the authority having jurisdiction such as a Marine Chemist, a Coast Guard–authorized person, or a shipyard competent person requires that a fire watch be posted.

4.5.2.2 Persons acting as the fire watch shall meet the following criteria:

(1) Not be assigned other duties
(2) Have a clear view of and immediate access to all areas included in the fire watch
(3) Are able to communicate with workers exposed to hot work, if necessary
(4) Remain in the hot work area for at least 30 minutes after completion of the hot work, unless the employer or the employer's representative surveys the exposed area and makes a determination that there is no further fire hazard
(5) Are trained to detect fires that occur in areas exposed to the hot work
(6) Attempt to extinguish any incipient-stage fires in the hot work area that are within the capability of available equipment and within the fire watch's training qualifications
(7) Alert employees of any fire beyond the incipient stage
(8) If unable to extinguish fire in the areas exposed to the hot work, activate the alarm to start the evacuation procedure in accordance with the fire prevention plan

4.5.3 When it is necessary to remove combustible insulation to a safe distance from the location where welding or burning is to be done, measures shall be taken to prevent sparks or hot slag from entering exposed insulated spaces.

4.5.3.1 Doorways, hatch and tank openings, portholes, and so forth, shall be protected where there is a danger of sparks or hot slag dropping or ricocheting into such openings and igniting combustible materials.

4.5.4 Where hot work processes cannot be safeguarded for making necessary repairs, such repairs shall be accomplished by safer means, such as by drilling, sawing, bolting, or other appropriate methods.

Occupational Safety and Health Standards (OSHA) for Shipyard Employment, Fire Protection in Shipyard Employment 29 CFR 1915.503 Precautions for Hot Work.

1915.503(a)(2)(ii) The employer shall authorize employees to perform hot work only in areas that are free of fire hazards, or that have been controlled by physical isolation, fire watches, or other positive means.

Hollow Structures. 29 CFR 1915.54, Welding, cutting and heating of hollow metal containers and structures not covered by 1915.12.

The provisions of this section shall apply to ship repairing, shipbuilding and shipbreaking.

1915.54(a) Drums, containers, or hollow structures which have contained flammable substances shall, before welding, cutting, or heating is undertaken on them, either be filled with water or thoroughly cleaned of such substances and ventilated and tested.

1915.54(b) Before heat is applied to a drum, container, or hollow structure, a vent or opening shall be provided for the release of any built-up pressure during the application of heat.

1915.54(c) Before welding, cutting, heating or brazing is begun on structural voids such as skegs, bilge keels, fair waters, masts, booms, support stanchions, pipe stanchions or railings, a competent person shall inspect the object and, if necessary, test it for the presence of flammable liquids or vapors. If flammable liquids or vapors are present, the object shall be made safe.

1915.54(d) Objects such as those listed in paragraph (c) of this section shall also be inspected to determine whether water or other non-flammable liquids are present which, when heated, would build up excessive pressure. If such liquids are determined to be present, the object shall be vented, cooled, or otherwise made safe during the application of heat.

1915.54(e) Jacketed vessels shall be vented before and during welding, cutting or heating operations in order to release any pressure which may build up during the application of heat.

From 29 CFR 1915 Subpart B Appendix A, Compliance Assistance Guidelines for Confined and Enclosed Spaces and Other Dangerous Atmospheres

Prior to hot work on any hollow structure, the void space should be tested and appropriate precautions taken.

Marine Terminals. 29 CFR 1917.152 Welding, cutting and heating (hot work)

1917.152(c) Fire protection.

1917.152(c)(1) To the extent possible, hot work shall be performed in designated locations that are free of hazards.

1917.152(c)(2) When hot work must be performed in a location that is not free of hazards, all necessary precautions shall be taken to confine heat, sparks, and slag so that they cannot contact flammable or combustible material.

1917.152(c)(3) Fire extinguishing equipment suitable for the location shall be immediately available and shall be maintained in readiness for use at all times.

1917.152(c)(4) When the hot work operation is such that normal fire prevention precautions are not sufficient, additional personnel shall be assigned to guard against fire during hot work and for a sufficient time after completion of the work to ensure that no fire hazard remains. The employer shall instruct all employees involved in hot work operations as to potential fire hazards and the use of firefighting equipment.

1917.152(c)(6) When openings or cracks in flooring cannot be closed, precautions shall be taken to ensure that no employees or flammable or combustible materials on the floor below are exposed to sparks dropping through the floor. Similar precautions shall be taken regarding cracks or holes in walls, open doorways and open or broken windows.

International Maritime Organization (IMO) MSC/Circ.1084, *Principles for Hot Work on Board All Types of Ships*, 13 June 2003.

2.5 A written plan for the operation should be agreed by all who will have responsibilities in connection with the hot work.

2.6 The work area should be carefully prepared and isolated before hot work commences.

2.7 Fire safety precautions should be reviewed, including fire equipment preparations, setting a fire watch in adjacent compartments and areas, and fire-extinguishing measures.

2.8 Isolation of the work area and fire precautions should be continued until the risk of fire no longer exists.