

Extinguishing fires in spaces protected by Fixed Gas Fire Extinguishing Systems

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In reading the National Transportation Safety Board (NTSB) investigation of the engine room fire aboard the Towing Vessel (TV) *Patrice McAllister* which occurred March 27th, 2012, I find many parallels to NOAA's shipboard and small boat fleet operations. All NOAA vessels 40' and greater have fixed gas fire extinguishing systems (FFE) protecting spaces containing propulsion machinery or an internal combustion engine of more than 50hp. With the installation of FFE's, specific and detailed procedures must be followed in order for the fire to be successfully extinguished. In addition, spaces containing FFE's must have their fire boundary integrity maintained to effectively contain the extinguishing agent once it has been released. The *Patrice McAllister* investigation revealed several deficiencies both preexisting and during the execution of the extinguishing process. We can take some specific and relevant information from the NTSB report:

1. "The lack of fire dampers in ventilation systems, along with compromised boundaries due to holes, openings, and casual modification, appear to be major problems in containing fires".

How does this relate to NOAA vessels? We have a variety of vessels in our fleet. Some of our vessels are much older than others. As technology evolves, mission requirements change, and life-cycle repairs are conducted, the opportunity can arise for fire boundaries to be inadvertently compromised. I have found equipment mounted over the openings of ventilation ducts in fire boundaries eliminating the ability to secure it in the event of a fire. On the smaller research vessels, scientific equipment is routinely added or removed requiring the installation of wiring and or piping that transits through machinery space fire boundaries. This is common, it's what we do. Unless these transits are correctly installed the fire boundary may be compromised allowing the extinguishing agent to escape or air to be let in after the fire is extinguished. We look for this extensively during inspections of any NOAA vessel.

2. "The inability to completely secure the engine room's fire boundaries; and the abundance of flammable material throughout the vessel."

When the master of *Patrice McAllister* ordered the release of the extinguishing agent, the ventilation openings to the machinery space were not closed, nor were they even installed. Although our vessels are fitted with machinery space ventilation dampers, they will not do any good if they are not quickly and effectively closed prior to the release of the extinguishing agent. Some dampers will automatically close upon release of the agent, some require personnel to manually deploy them. In either case we have to be properly trained to quickly

deploy or verify automatic systems function during maintenance and testing of the systems. Relying solely on fire servicing companies to ensure complete effectiveness and functionality of these systems is inadvisable. Trust, then verify, should be on the forefront of anyone responsible for this procedure.

3. "Contributing to the extent of the fire damage was the crewmembers' compromise of the fire boundaries when they prematurely began de-smoking the vessel's superstructure..."

The need to quickly resolve the situation and satisfy ones' curiosity as to the extent of damage after a fire is a direct cause of number 3. We have to remember that most fires within a vessel compartment are caused from equipment operating outside of its intended parameters. Fire consumes combustibles, damages wiring, and can even melt metals causing catastrophic damage. We have to ask ourselves, do we really need to get back into that space right now? The answer is generally, no. With that in mind the focus of the response crew should be maintaining the integrity of the fire boundaries, cooling the boundaries to prevent conductive heat spreading the fire, and the safety of the personnel onboard. We don't need to open the space to know if the fire is out. A small amount of smoke will escape through vent closures and will tell you everything you need to know.

BLACK SMOKE: Combustion process evident, fuel needed for combustion plentiful, oxygen present needed to sustain combustion.

GREY SMOKE: Combustion minimal, fuel needed for combustion depleting or removed from the combustion process, oxygen being depleted or chemically restricted from the combustion process.

WHITE SMOKE: Combustion terminated, fuel needed for combustion removed from the combustion process, oxygen depleted or removed terminating combustion.

Using visual cues from bulkheads and decks such as blistering paint, furnishings and coverings attached to bulkheads and decks beginning to smoke, or the outright destruction of the fire boundary due to heat damage will give you information on what to do next.

In my career as a Marine Inspection Officer and Casualty Investigator, I have investigated around a dozen machinery space fires that resulted in extensive secondary damage to the vessel outside of the fire's originating area or complete loss of the vessel. In those cases one or all of the following circumstances were prevalent in each and every situation:

- 1. The fixed gas extinguishing system did not function as intended due to mechanical failure(s) of the extinguishing system caused either through poor servicing history or the extinguishing device was not operational prior to the fire.*
- 2. The vessel crew did not effectively extinguish the fire either from failure to secure ventilation closures within the fire boundary or by not correctly deploying the fixed gas system in accordance with vessel specific emergency procedures.*
- 3. The vessel crew intentionally breached the fire boundaries after the fixed gas system was deployed allowing the extinguishing agent to escape and or allowing fresh air to feed the combustion process and reignite the fire.*

We must have functioning FFE's that have been serviced properly by the appropriate servicing entities and verify this has been done correctly and we must train relentlessly on the procedures to be accomplished to effectively extinguish a fire using FFE's. I can guarantee only two outcomes from a fire. You will either successfully extinguish the fire and save your vessel or you will be rapidly looking for a way to get off of it.