Fixed Firefighting Systems

HALON AGENT

GENERAL INFORMATION

The word Halons is short for "halogenated hydrocarbons", in other words, hydrocarbons containing one or more of the halogens--fluorine, chlorine, or bromine.

Halons have certain advantages over carbon oxide. Less Halon than carbon dioxide, for example, would be needed to extinguish a fire of the same size. This is an important consideration on ships with their weight and space limitations. In addition, there is some evidence that Halons can extinguish engine room fires more quickly than carbon dioxide can. The Halons used in firefighting systems are thought to be effective in breaking the chain reaction which is the mechanism that keeps fires going. Since the Halon extinguishes the fire by putting an end to this reaction rather than by filling the room and displacing the oxygen, as carbon dioxide does, lower concentrations can be used. Whereas carbon dioxide would require a concentration of 28.5% to be effective, Halon 1301, which is typically used onboard ships, will extinguish a fire at a concentration level of 6%. This could be vitally important in the case of accidental release. Since the halon-air mixture would contain 94% air and only 6% Halon, personnel trapped in an enclosed space with it, would not be asphyxiated.

Halon is not manufactured anymore. It is regulated by the EPA as a greenhouse depleting gas. Existing stockpiles may be purchased but no manufacturing is to take place. If the system is discharged it will most likely be fitted with a new type of extinguishing agent. Halon 1301 (the Halon most commonly used for fire extinguishing purposes) decomposes to form two toxic gases, hydrogen fluoride and hydrogen bromide, when it is exposed to heat. The American Conference of Governmental Industrial Hygienists has set recommended maximum exposure levels for these two gases. If personnel must be exposed to them, the concentration to which they are exposed should not exceed 3 parts per million (ppm), averaged over the eight hour workday.

No data were available on how much hydrogen fluoride and hydrogen bromide were generated when Halon was released or how effective Halon 1301 was in extinguishing machinery space fires, when the Coast Guard began drafting safety regulations for Halon. To acquire the necessary data, the Coast Guard, with support from the marine firefighting industry, ran a series of tests in 1970 in the engine room of a full-scale ship at the U.S. Coast Guard Fire and Safety Test Detachment in Mobile, Alabama. The concentration of hydrogen fluoride measured following release of Halon 1301 varied from 0.1 to 230 ppm and the concentration of hydrogen bromide from 0.6 to 68 ppm.

One of the factors responsible for the wide range of values recorded was the speed of discharge: the faster the discharge, the lower the concentration of toxic gases measured. Unfortunately, releasing Halon very rapidly endangers the

people in its path, possibly knocking them down or causing the Halon to be injected under their skin. The concentrations in the upper range, on the other hand, are much too high for humans. The Coast Guard concluded in its study that personnel should be evacuated prior to release of Halon.

While Halon in its usual concentration of 6% will not cause asphyxiation, it is a chemical and personnel should not breath it indiscriminately. The recommended exposure limit for Halon 1301 for cases of short-term exposure to a high concentration (in an emergency, for example) is 1,200 ppm. A 6% concentration translates to 60,000 ppm, well above the range deemed acceptable. In addition to concerns over the immediate effects of breathing Halon 1301, hydrogen fluoride, and hydrogen bromide, there are questions about the long-term effects, largely unknown, of exposure to these gases.

The Coast Guard published guidelines for the use of Halon in a Navigation and Vessel Inspection Circular (NVIC 6-72, Change 1, "Guide to Fixed Fire Fighting Equipment Aboard Merchant Vessels"). The Coast Guard recommends that the activation device for Halon systems be located outside the space outfitted with the system, so that the Halon can be released without exposing anyone to harmful gases. It also recommends a delay in permit evacuation.

Hazards to Personnel

Halon 1301 may be discharged in afire situation or may be inadvertently released where no fire exists. In both cases potential hazards exist.

a. Where no fire exists, the following personnel hazards may arise upon Halon discharge:

    1. **Noise.** Discharge of a system is noisy enough to be startling.

    2. **Turbulence.** High velocity discharge from nozzles may be sufficient to move unsecured paper and light objects.

    3. **Cold Temperature.** Direct contact with vaporizing liquid being discharged from a Halon 1301 system may have a strong chilling effect on objects and can cause frost-bite burns to the skin. The liquid phase vaporizes rapidly when mixed with air and thus limits the hazard to the immediate vicinity of the nozzle.

    4. **Obscured Vision.** In humid atmospheres, reduction in visibility may occur briefly because of condensation of water vapor in the air. For whatever reasons, should personnel be trapped in a space while Halon is discharged, and fogging of the atmosphere occurs, personnel are cautioned not to move until vision improves, moving blindly in an obscured atmosphere could result in personnel injuries.

    5. **Securing of Machinery Plant.** For all situations where the Halon 1301 system is actuated, (either because of fire or inadvertently), alert the central

damage control station and conduct an orderly shutdown of the machinery plant. Where an orderly machinery plant wrap up is not possible, all machinery should be secured quickly from a remote location. Upon evacuation and last man out, all evacuees should be accounted for. Be certain all hatches are firmly secured during system discharge. Establish communications as early as possible between all machinery spaces, and damage control central. Particular attention is directed to the ventilation exhaust blowers. If the ventilation system is not secured prior to Halon discharge, the extinguishing system may not function properly. The Halon concentration in the machinery space will be reduced because some Halon will be exhausted from the space.

Where a fire exists, additional personnel hazards may arise upon Halon discharge, extinguishment of fire by Halon 1301 results in the generation of toxic by-products. Decomposition occurs when Halon comes in contact with flames or surfaces above 900 degrees F. Normally these by-products reach only low concentration levels where the fire is extinguished. The main decomposition products are Hydrogen Fluoride, Hydrogen Bromide and Free Bromide. Hydrogen Fluoride and Hydrogen Bromide in vapor form are colorless. However, even in minute concentrations of a few parts per million, these decomposition products have a characteristically sharp acrid odor. This characteristic provides a built-in warning system for the agent, but at the same time creates a noxious irritating atmosphere in addition to the smoke irritant for those who must enter the hazard area following a fire.

As with all compartment fires, personnel outside the space should avoid fire gases and decomposition products discharged from ventilation exhaust and stacks. All reentry personnel must wear self-contained Oxygen Breathing Apparatus (OBA). Reentry will be done only when the pneumatic switches have been reset, the ventilation system operated for 15 minutes, and the atmosphere has been tested. Try to determine the temperature conditions within the space before reentry.

SCBA and AFFF hose to extinguish smoldering fires will be used when reentering the space. Remember, the primary purpose of the reentry party is to determine that the casualty has been corrected. Detailed reentry procedures have been included in Chapter 9930 of the naval ships technical manual. Effective ventilation to dissipate hazardous atmospheres should precede all reentry attempts without SCBA's. It should be noted that the pressure switch that secures the ventilation fans must be reset prior to restarting the fans. This will require entry into the space by personnel wearing SCBA's.

HALON SYSTEMS, C02 SYSTEMS

INTRODUCTION

The T/V Kings Pointer has six Halon Systems located throughout the ship. They serve in the Aft Shop/Welding Shop, Emergency Generator Room, Main Generator

Room, Main Propulsion Motor Room, Bow Thruster Room, and Paint locker. The ship also has two C02 systems for the propulsion motors.

Halon 1301 is a colorless, odorless, electrically non-conductive gas that is an effective medium for extinguishing fire. Halon 1301 extinguishes fire by inhibiting the chemical reaction of fuel and oxygen. The extinguishing effect due to cooling, dilution of oxygen or fuel vapor concentration is minor.

The primary function of the system is to extinguish m achinery space fires which are beyond the capabilities of other extinguishing systems apparatus and where abandonment of the space is necessary. The system is designed for rapid discharge and will expend in approximately (10) seconds.

FUNCTIONAL DESCRIPTION

Main Generator Room

The Main Generator Room Halon System consists of: two 292 Ibs. Halon 1301 cylinders, a 50 Ibs. C02 cylinder, three pull boxes (cylinder release), three pull boxes (valve releases), one pneumatic siren, six pneumatic switches for ventilation shutdown, and diesel engine shutdown, and a time delay. The pull boxes are located in the Machinery Access and Removal Trunk at Frame 30 in Passage 2-22-1, and the Halon Stowage Roam 1-40-1.

Emergency Diesel Generator Room

The Emergency Generator Room Halon System consists of: one 90 Ibs. Halon 1301 cylinder, 50 Ibs. C02 cylinder, a time delay, a pneumatic siren, two pneumatic switches to secure diesel air intake and cooling air exhaust and fuel oil to engine and 2 pull boxes. The pull boxes are located in Passage 01-10-0.

Array/Winch Shop

The major components of the Array/Winch Shop Halon System are: a 72 Ibs. Halon 1301 cylinder, a pneumatic switch to secure ventilation, a 50 Ibs. C02 cylinder, a time delay, a pneumatic siren and 2 pull boxes. The system is placed into operation by pulling the cables from the pull boxes located just outside the entrance of the Array/Winch Shop 1-75-2.

Bow Thruster Room

The major components of the Bow Thruster Room Halon System are: a 42 Ibs. Halon cylinder, 50 Ibs C02 cylinder, a time delay, a pneumatic siren, a pressure switch to secure ventilation and 2 pull boxes. The pull boxes are located in the stbd. bulkhead just above the Bow Thruster Room.

Propulsion Motor Room

The Propulsion Motor Room Halon consists of: two 96 Ibs. Halon cylinder, 50 Ibs C02 cylinder, a time delay, 2 pneumatic sirens, 2 pressure switches to secure ventilation and 2 pull boxes. The pull boxes are located in the Main Control Room on the aft bulkhead by the Main Control Room/Propulsion Motor Room hatch.

Paint Lockers

The Paint Lockers are located on the boat deck at Frame 44 each locker has a Halon System installed. The system are either automatically actuated utilizing a 160 degree fusible link or manually actuated by utilizing manual pull boxes. To paint are protected from over pressurization in case the halon is discharged. The Halon system contains Halon 1301.

$C0_2$ Systems

Each Propulsion Motor is equipped with a CO_2 fire fighting system. Each system has a 50 Ibs $C0_2$ cylinder, pressure switch to secure the Propulsion Motor, and a pullbox. The pullboxes are located in the Main Control Room on the aft bulkhead by the Main Control Room/Propulsion Motor Room watertight door.