514-31

NASA Issues Related To Use Of Halon: Past, Present, Future

Michelle M. Collins, P.E.
NASA, JJ-D
Environmental Program Office
Kennedy Space Center, FL 32899
(407) 867-4270, Fax: 407-867-8040
Michelle.Collins@ksc.nasa.gov

INTRODUCTION

NASA began an official halon phaseout program in 1990. NASA has led the way in halon bank management and has participated in the search for halon alternatives. NASA representatives participate in technical committees of the National Fire Protection Association and United Nations Environment Program providing guidance on Halon Phaseout and acceptance, design, installation, and maintenance of Halon Alternatives. This paper addresses some of the key issues that are leading the agency away from dependence on halons for fire protection.

Although the groundwork was being laid a year earlier, NASA officially began their Halon Phaseout Program in 1990. The program was comprehensive in that it addressed all aspects of phaseout and bank management; including defining "critical" for the agency, identifying critical uses, development of a plan to phaseout non-critical systems, upgrading of critical systems and their hazard enclosures, establishment of recycling and storage, setting aside backup systems, upgrading of maintenance procedures and documentation, updating policies and fire protection guidelines for the agency, participating in the standards making process and decision-making process on both a national and international level, and participating in R&D for alternatives. Many of the aforementioned steps were accomplished in the first five years of the program. NASA is still underway with the phaseout according to the original schedule. At the time the agency embarked upon this program, there were no alternatives available. All plans had to be made based on the possibility that alternatives would not be found along with the flexibility to adapt to alternatives if and when they did become available. The agency continues to participate in the regulatory process affecting halon use and replacements, as well as, participating in R&D to expand replacement options. The following three sections address specific aspects to NASA's past experience in phasing out halons, NASA's present fire protection activities, and NASA's future plans.

NASA's **Past** Experience with Halon Total Flooding Systems:

This section is split into three areas; 1) Lessons Learned, 2) Maintenance Issues, and 3) Documentation-Related Issues. The lessons learned and difficulties encountered will be the same for the use of any total flooding agent/system whether it is a first or second-generation halon replacement or an inert gas system. Before making a decision to install a total flooding system, the user and Authority Having Jurisdiction (AHJ) must be aware of the additional responsibilities, maintenance, and documentation associated with a total flooding gaseous system. Some of the more notable lessons learned are listed as follows:

Lessons Learned:

- Although a hazard area is manned 24 hours per day, experience showed that the occupants may not evacuate the space nor apply/manually-activate a fire suppressant.
- Tape storage, in many instances, was not located in a separate hazard area from the "essential electronic equipment", and hazard areas were not always separated.

- Occupancies had changed, and a halon fire suppression system was no longer necessary for the hazard area.
- Hazard enclosures had been changed in size and configuration without modifying the halon system (rendering it insufficient or ineffective).
- Cylinders were below design fill levels (again rendering the system insufficient for the fire hazard) as a result of slow leaks.
- Many systems were not capable of suppressing a fire in their state and the state of the enclosure, thus giving a false sense of security.

Maintenance Issues:

- Cylinders were from many different manufacturers, which made it difficult to maintain and stock adequate spares. The maintenance crew had to be trained on each different type of system and the training kept up-to-date. This is difficult to achieve and expensive to sustain. The cylinders, actuators, detection, and controls were outdated and more leaky and accident prone. Upgrades were performed for those systems deemed "critical" by the agency.
- Softgoods must be replaced on a regular basis.
- Leak detection must be performed regularly during maintenance. Cylinder heads were found to be leaking into the manifold.
- Rewrite maintenance instructions to reflect each individual system. If a boilerplate is used, it is very likely accidental discharges will occur during maintenance.
- Establish critical spares. If a total flooding system is deemed essential, and the investment is made, then a standby replacement bank should be an integral part of that system (unless the user can afford the down-time necessary to recharge the system).
- Fan pressurization testing can be very useful in determining the enclosure leakage and to verify the design agent concentration. Kennedy Space Center's (KSC) experience has been mixed with regard to the fan pressurization test. Some users do not like it; it "appears" disruptive to their operations. The rooms with raised floors and drop ceilings were the most difficult to locate leaks and seal up. In many cases the configurations of the rooms around the hazard area were not conducive to the fan test as the control of doors and pressures in adjacent spaces would skew test results. In addition, it is difficult to maintain a trained crew to perform the tests.
- Make sure the owner has the means to perform or contract adequate maintenance. A total flooding system is a large investment. It is NASA's policy that total flooding systems for electronic areas should be secondary fire suppression systems with wet pipe sprinklers as the primary for total loss control. In many cases funding was not available for both, and the primary system became the total flooding system. This put the entire facility at risk. NASA is a government agency (self-insured) and should have had a primary wet pipe sprinkler system first.
- The total flooding system must be tied into the HVAC system and/or appropriate dampers installed to isolate the enclosure.

Documentation-Related Issues:

- Ensure the agent/system is UL Listed or FM Approved and listed in the NFPA Standards.
- Replacement lifetime should be considered along with occupancy plans. Perform life cycle cost analysis before making final selection.
- Stay informed of changes in NFPA standards ; become involved.
- Ensure maintenance documentation is in place and reflects each individual system.
- Provide awareness and training to users on the system.
- Label hazard enclosure walls, floor, and ceiling (i.e. "Do not modify or make penetrations without contacting responsible fire protection engineer").
- Maintain control of the agent. Bar-coding of cylinders has been useful in tracking changes in agent quantities on an annual basis. Data entry occurs during maintenance. Accidental or unnecessary loss can cause a great deal of downtime (which translates to $) and large sums of $ for some of the replacement agents.

NASA's PRESENT Plans For Facility Fire Protection:

NASA has implemented procedures to minimize leakage and accidental discharges as outlined above. These procedures are applicable to any total flooding system and have resulted in significant cost savings and a minimization of impact to the users. As the agency moves forward with its phaseout of halon there are a number of activities that are important both to the phaseout program and the optimization of a successful fire protection program. Some of these key activities are listed below.

- Maintain accurate, up-to-date documentation including NASA's and Agency Center's Fire Protection Standards which address applications not covered in NFPA Standards.
- Ensure the fire department is aware of the special applications; response time must be adequate if a secondary system is not used. At KSC the response time is less than four minutes.
- Install wet pipe sprinklers as primary protection for major loss control. NASA is self-insured meaning that any fire loss must be absorbed within the existing annual budget allocation.
- In the case of special electronic equipment rooms or facilities, a secondary system like a total flooding clean agent can be installed if the contents are high value and funds are available and/or the application of water could cause loss of life or loss of vehicle (space shuttle).
- Install advanced detection systems; VESDA, AnaLASER, etc. Types of detection systems in use at KSC include Spot Heat, Spot Smoke, Beam, Aspiration, Linear Wire, Heat UV, and UV/IR.
- The agency does not have plans to install any of the halon replacements currently available.
- Most NASA Centers have personnel for on-site engineering, maintenance, and operations. Fire inspectors conduct daily walk downs and Fire Protection Engineers perform Fire Risk Surveys on every major facility on a periodic basis. A Fire Risk Review Board, consisting of upper management, reviews fire protection deficiencies and they decide to either fund the solutions or make the programmatic decision to accept the risk. In addition, Fire & Safety Engineers from each NASA Center meet annually for technical interchange.
- Fundamental Fire protection engineering is practiced at all NASA Centers. This includes utilizing fire retardant materials, separating hazards, building in redundancy, backing up electronic data on a regular basis, etc.

The FUTURE of Fire Protection without Halon at NASA Facilities:

NASA is proceeding with a sound plan for facility-based fire protection by practicing good fire engineering fundamentals, participating in the decision-making and standards-making processes, staying abreast of the latest technologies available, and participating in research and development of advanced fire suppression. NASA's halon phaseout is proceeding on schedule as a result of grounding ourselves in solid fundamental fire protection practices. The future begins now with the following steps being taken by the agency ...

- Modifications to the "Firing Rooms" in the Launch Control Facility at KSC consist of double-interlock pre-action sprinkler systems with smoke aspiration systems for early warning and gaseous portable extinguishers for early response.
- The agency will continue to invest into R&D for halon alternative options.
- NASA plans to stay involved in the Standard's making process and Decision making process; this involvement allows the agency to influence its future and stay abreast of changes in halon replacement options.
- NASA plans to team up R&D efforts with the DOD to address special needs.

As halon alternatives continue to evolve, NASA will continue to evaluate their applicability and adapt its fire protection program to incorporate them as appropriate.