


Pollution Prevention | Appendix Z: Ozone-Depleting Substances

The Department of Defense (DoD) is committed to reducing the use of chemicals that negatively impact the environment. Executive Order (E.O.) 13423, entitled, "Strengthening Federal Environmental, Energy, and Transportation Management" and the "Instructions for Implementing E.O. 13423," require DoD and other federal agencies to reduce and manage the use of ozone-depleting substances (ODSs) at federal facilities. DoD is a leader in ODS reduction and was one of the first organizations, after the Montreal Protocol was signed, to commit to finding solutions to reduce the use of ODSs. In 2007, during the 20th anniversary celebration of the Montreal Protocol, DoD received a Best-of-the-Best Stratospheric Ozone Protection Award from the U.S. Environmental Protection Agency (EPA). The Department was presented with the award for their leadership in military ozone layer protection and in developing and deploying ozone-friendly policies and technologies.

ODSs may accelerate ozone layer destruction, resulting in lower-than-normal ozone levels. A diminished stratospheric ozone layer allows more radiation to reach the Earth's surface. For many people, overexposure to ultraviolet (UV) rays can lead to skin cancer, cataracts, and weakened immune systems. Increased UV radiation is also a factor in reduced crop yield and disruptions in the marine food chain. There are two types of ODSs, Class I and Class II substances; Class I ODSs have a higher ozone-depleting potential than Class II substances. Examples of Class I substances, listed in the Clean Air Act, include chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform. EPA later added hydrobromofluorocarbons, methyl bromide, and chlorobromomethane to the list. When CFCs reach the stratosphere, the UV radiation from the sun causes these molecules to break down and release chlorine atoms which react with ozone, initiating the chemical cycles of ozone destruction that deplete the ozone layer. To ensure progress towards reducing ODS usage, DoD requires that Components annually report the status of ODSs reduction plans in place or under development.

DoD established an ODS Reserve, located in Richmond, Virginia, as an essential part of the Department's plan for phasing out the use of ODSs. The ODS Reserve provides DoD with the capability to recover and centrally receive, reclaim, and issue ODSs. The importance of this inventory has escalated since replacement of ODSs has proven to be more difficult than projected and alternatives are not as available as expected. Military uses for ODSs include shipboard and submarine refrigeration, on-board aircraft, carrier deck and flight line fire protection, and armored vehicle explosion suppression. To date, the Military Components have recovered and turned in approximately 10 million pounds of product for reclamation.

Army

The Army remains committed to the elimination of Class I ODSs. Since 1992, the Army has eliminated all dependency on the commercial availability of Class I ODSs on its installations, and eliminated 98 percent of their use in facilities applications (99 percent of CFC use and 95 percent of halon fire suppressant). The Army will not allow a continued dependency on Class I ODSs to degrade the operational readiness of its installations, weapon systems, and industrial processes.

Army installations eliminated their dependency on purchasing new Class I ODSs. Though it is the responsibility of the installations to reuse CFC refrigerants recovered from retired or retrofitted air conditioning and refrigeration (AC&R) systems, installations are prohibited from supporting existing AC&R systems with new CFC refrigerants. Likewise, installations may still operate building fire suppression systems that use halon, but must retrofit them with a non-ODS system (preferably water) when discharged. Installations are prohibited from purchasing new halon or reusing halon recovered from retrofitted or retired building fire suppression systems. All recovered halon is turned in to the DoD ODS Reserve.

Beginning in 2005, the Army implemented a new, aggressive ODS elimination policy, which emphasized the elimination of ODSs from legacy weapon systems. One example of how the Army complies with this policy is by continuing to retrofit the engine compartment fire suppression system in the Abrams Main Battle Tank. Program Management (PM) Office Combat Systems, in cooperation with Anniston Army Depot, replaced the Halon 1301 system with a system based on dry powder using baking soda. The Army

plans to convert the entire fleet of Abrams Main Battle Tanks by 2015. During the same period, the Army also began retrofitting the engine fire suppression system in the M992 Field Artillery Ammunition Support Vehicle, and continued the eight-year effort to retrofit Army watercraft, including Logistics Support Vehicles, Landing Craft Utility, and ocean-rated tugs, from Halon 1301 to the alternative non-ODS gas FM-200. The conversion is scheduled for completion by 2012.

In addition, the Army completed the conversion of the last CFC refrigerants in tactical vehicles, including the Army's primary ambulance, the High-Mobility Multipurpose Wheeled Vehicle (HMMWV) version M997. This field retrofit, undertaken by PM Light Tactical Vehicles, replaced the Freon R-12 refrigerant with hydrofluorocarbon (HFC) refrigerant R-134a. The DoD ODS Reserve will soon formally have only one identified Army Class I ODS requirement: the Halon 1301. This is a reduction from the five products supported in 1995.

The Army is a world leader in the elimination of ODSs in the area of helicopter engine nacelle fire suppression and natural refrigerant development. The Program Executive Office, Aviation, in conjunction with PM Apache, PM Utility Helicopter, and PM Cargo Helicopter, continues efforts to qualify halon replacement using HFC-125 for aircraft nacelles. For new Army aircraft and life-extension programs that extend existing Army aircraft systems beyond 2030, a qualified halon alternative is needed to ensure that operational readiness is not compromised. The Army selected HFC-125 as the sole fire suppression agent. As part of contingency planning, the 46th Air Force Test Wing at Wright-Patterson Air Force Base is conducting qualification tests.

The Army also continues to be a world leader in the development of natural or alternative refrigerant cooling. Carbon dioxide (CO_2) is expected to replace Class II ODSs in tactical air conditioning systems by 2010. In 2005, the U.S. Communications and Electronics Research, Development, and Engineering Center (CERDEC) successfully demonstrated an under-the-hood CO_2 air conditioner for the up-armored HMMWV (M1114). The CERDEC continues its efforts in the development of a CO_2 Environmental Control Unit (ECU) by providing cooler air more quickly (and in a smaller package) than ECUs currently fielded.

Navy

Prior to the early 1990s, Class I ODSs played a vital role in the mission-critical operations of virtually every ship and aircraft in the U.S. Naval Fleet. As a result of the phase-out of Class I ODSs, the Navy developed a comprehensive four-pronged approach to eliminate the use of Class I ODSs at facilities and in mission-critical weapon systems. This approach included conservation of existing supplies of Class I ODSs; establishment of a mission-critical reserve (stockpile) of Class I ODSs that would support the Fleet until individual systems were converted or retired from service; development of next-generation, ozone-friendly systems designed for new acquisition programs; and conversion of existing systems using Class I ODSs to environmentally preferable alternatives when technically and economically feasible. Since 1989, this comprehensive program plan has reduced the Navy's annual consumption of Class I ODSs by over 95 percent.

For shore facilities, Navy policy required the retrofit or replacement of air conditioning and refrigeration equipment that contained CFC refrigerants no later than December 2000, unless a waiver was approved. To date, the Navy has retrofitted or replaced nearly all of the 3,000 CFC-containing air conditioning and refrigeration systems at shore facilities. The few remaining units operate under temporary waivers and are either scheduled for replacement before 2010, or may operate until the end of their service life only if they can be supported by existing recycled CFC supplies. Navy policy also prohibits the refill of existing shore facility halon fire suppression systems in the event of discharge thus meeting the goals of E.O. 13423 regarding acquisition and the reduction and elimination of toxic and hazardous materials. In addition, Navy policy has restricted the acquisition of equipment utilizing Class II ODSs since the mid-1990s; therefore, it is anticipated that Navy shore facilities will be ahead of the industry in replacing these substances.

On mission-critical legacy weapons platforms, the Navy uses a combination of retrofit and end-of-life phaseout for Class I ODSs, thus balancing operational and environmental risks while still meeting the directives of E.O. 13423. For example, between 1993 and 2007, the Navy retrofitted over 1,150 shipboard AC&R systems to non-CFC refrigerants, and used CFC refrigerant recovered from these retrofits to support other mission critical systems until the end of their useful life.

For new design weapons platforms, the Navy has shown leadership in developing and implementing safe, cost-effective, and environmentally preferable alternatives to Class I ODSs. For example, in the late 1990s, Navy F/A-18E/F and V-22 aircraft were the first aircraft in the world to fly with non-halon engine nacelle fire suppression systems. The Navy continues to lead the world in aviation halon replacements by installing non-halon systems in UH-1Y and AH-1Z helicopters and E/A-18G aircraft. The Navy is also working on new halon-free fire suppression systems for many new aircraft including the MH-60R, MH-60S, CH-53K, VH-71, P-8A, E-2D, and F-35. It is projected that these efforts will eliminate approximately 43,000 pounds of halon in current and future aircraft fire protection systems. The Navy has also implemented several alternatives to halon on new construction ships, including environmentally benign water mist systems. In the area of refrigerants, new construction Navy ships now use high-efficiency non-CFC air conditioning and refrigeration systems, which are up to 20 to 35 percent more energy efficient than older CFC systems.

While the Navy's ODS elimination efforts have been underway for nearly 20 years, it continues to sustain leadership emphasis on these efforts as evidenced by a recent comprehensive update of ODS policies in the Navy's Environmental Readiness Program Manual. In recognition of Navy's ongoing efforts to eliminate ODSs, EPA presented six Best-of-the-Best Stratospheric Ozone Protection Awards to Navy organizations and individuals in 2007. Navy received over 10 percent of the total awards – more than any other organization.

Marine Corps

The Marine Corps has completed implementation of ODS elimination initiatives at the installation level. With the exception of Marine Corps Base (MCB) Camp Butler, Japan, and MCB Hawaii, all Marine Corps installations have transitioned to non-ODS substitutes or technology. All Marine Corps installations are expected to transition to non-ODS substitutes or technology by December 2010.

The Defense Reserve of ODSs maintained by the Defense Logistics Agency (DLA) continues to support mission-critical applications for specified Marine Corps weapon systems, such as the Amphibious Assault Vehicle, the Light Armored Vehicle, and the M1A1 Main Battle Tank. The Marine Corps is implementing a transition plan to upgrade fire suppression systems for the Light Armored Vehicle to non-ODS technology.

Air Force

In 2007, EPA recognized the Air Force's ODS elimination efforts with two Best-of-the-Best Stratospheric Ozone Protection Awards. One award was given for the overall Air Force ODS management program and the other for work on aviation halon replacement.

Beginning in 1993, the Air Force adopted a centralized ODS management program to ensure the appropriate emphasis was placed on the elimination of ODS usage as technically and economically feasible alternatives became available. During the 1990s, it spent over $500 million towards reengineering processes, systems, and equipment at installations worldwide to eliminate over 96 percent of its original annual ODS usage. For the fraction of mission-critical halon applications that have needed to remain in use, the Air Force recovered halons from its decommissioned facility fire suppression systems and extinguishers to provide the vast majority of the material in its Defense Reserve stockpile. This was both fiscally and environmentally responsible, maximizing the use of recycled material and minimizing the need to purchase halon at the outset of the Reserve in 1994. Centralized management has also ensured that the Air Force has supported its systems while remaining within its original 1994 stockpile—requiring no new ODS purchases.

The Air Force's centralized management program ensures the responsible use of ODSs in the few mission critical applications that remain. This sustains mission capability while promoting environmental stewardship. In October 1999, the Air Force banned the purchase of Class I ODSs, and formally incorporated that ban into policy in 2004. The Air Force also ensures that all personnel are aware of the need to recover, reclaim, and reuse the Class I ODSs already available. The Air Force maintains these strict controls in both peacetime and in combat situations, where Class I ODS consumption can increase.

The Air Force Research Laboratory (AFRL) and Aeronautical Systems Center (ASC) has spent the last 15 years finding and implementing halon alternatives in the aerospace sector. AFRL led DoD and the Federal Aviation Administration (FAA) Halon Replacement Program for Aviation. As a direct result of AFRL's work, DoD selected HFC-125 for aircraft engine fire suppression. The Air Force and Navy provided the basis to develop and field the first aircraft in the world with non-halon engine fire suppression systems. The aircraft engineers, program management staff, and technical support at ASC developed one of those aircraft: the F-22A Raptor fighter, which began flying without halon in 2002. FAA has continued the work started by the Air Force, and recently qualified HFC-125 as one alternative to Halon 1301 for commercial aircraft engines.

The Air Force continues to monitor commercial technology development efforts and implement Class I ODS alternatives as they become available. In October 2007, the Air Force, working with the Navy, tested several commercially available fire extinguishers in an effort to identify a replacement for the 150-pound Halon 1211 flightline fire extinguishers. If successful, this would eliminate the largest remaining Air Force ODS use. As first responder protection for aircraft and their associated combat capability, these fire-extinguishing systems have extremely challenging performance requirements.

Most of the other remaining uses of Class I ODSs are in existing weapon and facility systems, which include Class I ODSs in the original equipment designs. The Air Force has not retrofitted these systems with non-ODS alternatives because it has been unable to find alternatives that are technically and economically feasible. For these few remaining Air Force Class I ODS applications, the primary method of elimination will be through attrition—the retirement of these facility and weapon systems at the end of their useful lives and replacement with new design systems that do not use ODSs. For example, the Air Force will replace over 2,000 F-15 and F-16 fighter aircraft in the next two decades, which require ODSs in integrated fire and explosion suppression systems, while the F-22 and F-35 aircraft have no ODS requirements.

DLA

DLA supports war-fighting readiness and preparedness through management of the DoD ODS Reserve, the only available source of Class I ODSs within DoD.

The ODS Reserve has established overseas collection points at DLA distribution depots at Germersheim, Germany; Pearl Harbor, Hawaii; and Yokosuka, Japan, to enhance the recycling effort and better facilitate the Military Component efforts to turn in ODSs. The recovery and reclamation process will continue for the life expectancy of the weapon systems being supported, which will be until mid-century.

In support of environmental concerns within the European Union (EU), the DoD ODS Reserve has established inventory within the bounds of the EU to support our critical weapons systems requirements. Access to those inventories is through special request to the ODS Reserve Program Office. The primary operational site is located in Richmond, Virginia, with secondary reclaim operations located in the Netherlands and at Warner Robins Air Force Base, Georgia. In addition to storing ODSs in Richmond, there are secure long-term storage locations on the east and west coasts of the U.S. and in Australia.

The DoD ODS Reserve has actively promoted federal-wide recovery and recycling of ODSs, and initiated agreements with the U.S. Postal Service, Central Intelligence Agency, U.S. Customs Service and other federal agencies for the recovery and reclamation of excess ODS stocks. The ODS Reserve has filled all requisitions authorized by the Military Services to maintain the readiness of U.S. military weapon systems. The Services are also in the final stages of requesting that the Reserve store a small amount of hydrochlorofluorocarbons (commonly known as R-22) for future needs.

A comprehensive guide for safe decommissioning of nitrogen-charged halon systems, which was developed under the direction of the ODS Reserve, is available on the Internet and is in use by commercial and government concerns worldwide. The DoD ODS Reserve has the full support of EPA and has become the model for reserve-type operations for foreign governments and for domestic and foreign commercial activities.