Appendix Z:
Ozone-Depleting Substances

The Department of Defense (DoD) is committed to reducing the use of chemicals that negatively impact the environment. Ozone-Depleting Substances (ODSs) are harmful compounds that contribute to stratospheric ozone depletion. A diminished stratospheric ozone layer allows higher levels of ultraviolet (UV) radiation to reach the Earth's surface. As exposure to UV radiation increases so does the risk of skin cancer, cataracts, and weakened immune systems. Increased UV radiation also is a factor in reduced crop yield and disruptions in the marine food chain. Through DoD's ODS Program, installations instead have used chemicals with lower ozone depletion potential (ODP), without sacrificing the mission or the warfighter's quality of life.

There are two types of ODSs, Class I and Class II substances. Class I ODSs have a higher ODP than Class II substances. Class I ODSs include chlorofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, and methyl bromide. Hydrobromofluorocarbons are included as Class II substances. DoD uses for ODSs include shipboard and submarine refrigeration and cooling, on-board aircraft, carrier deck and flight line fire protection, armored vehicle explosion suppression, and electronics cooling.

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 ODSs at their facilities. DoD is a leader in ODS reduction and was one of the first organizations, after the Montreal Protocol (an international agreement to phase out the production of ODSs) was signed in 1987, to commit to finding solutions to reduce the use of ODSs. DoD developed the world's first Halon 1301 alternatives for certain military weapon systems. 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. To date, the DoD Components have recovered and sent approximately 10 million pounds of ODS product for reclamation.

The Defense Logistics Agency (DLA) manages DoD's ODSs through a Defense Reserve located in Richmond, Virginia. The Defense Reserve accepts both used and unused CFCs, halons, and chlorodifluoromethane. As part of DoD's pollution prevention efforts, the Department has instituted specific requisitioning procedures to ensure these substances are handled safely and available only to authorized users. In addition to serving as a warehouse,

the Defense Reserve serves as a repair facility providing reclamation of turned in ODS and cylinder refurbishment. The Defense Reserve is an essential part of the Department's plan for phasing out the use of ODSs and 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.

To ensure progress toward reducing ODS usage, DoD requires Components to annually report the status of ODSs reduction plans that are in place or under development.

Army

The Army remains committed to removing ODSs from its inventory. The Army sees the continued dependency of its facilities and weapon systems on these substances as a readiness issue, one that will not be resolved until that dependency is eliminated. Since 1992, the Army has eliminated 98 percent of Class I ODS use in facilities applications (99 percent of CFC use and 96 percent of halon fire suppressants). The Army eliminated 50 percent of Class I ODS use in weapon system support in 2000, has reduced ODS use by over 70 percent, and projects to be under 20 percent of their 1992 use by 2015. In Fiscal Year (FY) 2008, the Army initiated a new program to reduce operational halon use by another 20 percent overall. The Army will not allow a continued dependency on Class I ODSs to degrade the operational readiness of our installations, weapon systems, and industrial processes.

Army installations are close to eliminating their dependency on the commercial availability of 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 they are discharged. Installations are prohibited from purchasing new halon or reusing halon recovered from retrofitted or retired building fire suppression systems. All recovered halon is sent to the Defense Reserve.

On March 16, 2004, the Army Acquisition Executive implemented a new, aggressive ODS policy to hasten the elimination of ODSs from weapon systems and industrial applications. One example of how the Army is implementing this policy is by continuing to retrofit the engine compartment fire suppression system of the Abrams Main Battle Tank. The Army is replacing the Halon 1301 system with one based on dry powder, using baking soda. The entire M1 fleet is expected to be converted by 2015. The Army already has converted the engine fire suppression systems of the M2/3 Bradley Fighting Vehicle System, the M9 Armored Combat Earthmover, and the Field Artillery Ammunition Supply Vehicle to a non-halon gaseous agent. In 1997, the Army began retrofitting the engine compartment fire suppression systems of all Army watercraft, including the Landing Craft Utility 1600 and 200 fleets and the Logistics Support Vessels. The project is expected to be completed at the end of FY2012.

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 Defense Reserve now has only one identified Army Class I ODS requirement, Halon 1301. This is a significant reduction from the five ODS products supported 10 years ago.

The Army is a world leader in replacing Halon 1301 in automatic explosion protection systems for manned spaces. These systems, installed in Army armored vehicles, must recognize and suppress a fuel-fed ballistic explosion in less than one-quarter of a second. The Army fielded the first non-halon system in the world in the Stryker Interim Armored Vehicle, and subsequently has fielded this technology in tactical vehicles up-armored in Iraq and Afghanistan in response to the threat of Improvised Explosive Devices. Efforts began during this fiscal year at the Army's Tank, Automotive and Armament Research, Development and Engineering Center to qualify this innovative technology for crew protection in the Army's front-line armored weapon systems.

The Army is a leader in the elimination of ODSs in helicopter engine nacelle fire suppression. The Program Executive Office, Aviation, in conjunction with the PM Apache Helicopter, the PM Utility Helicopter, and the PM Cargo Helicopter continues efforts to qualify halon replacement using hydrofluorocarbon HFC-125 for aircraft nacelles. For new Army aircraft and life-extension programs that extend existing Army aircraft systems beyond the year 2030, a qualified halon alternative ensures that operational readiness will not be compromised. The Army selected HFC-125 as the single, common halon alternative agent. The 46th Air Force Test Wing at Wright-Patterson Air Force Base concluded testing for the Army on helicopter nacelles, as did the Aviation Technical Test Center at Fort Rucker. Program specific qualification efforts are currently underway for the CH-47 Chinook and the UH-60 Blackhawk.

Additionally, the Army continues to develop natural refrigerant cooling alternatives. Carbon dioxide (CO_2) transcritical technology is expected to be competitive in the replacement of HFC refrigerants in tactical air conditioning systems in the 2015 through 2020 timeframe. In 2005, the U.S. Army 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). CERDEC is continuing to develop CO_2 Environmental Control Unit (ECU) technology, 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 nearly all ships and aircraft in the U.S. Naval Fleet. As a result of the phaseout 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 and establishment of a mission-critical reserve of Class I ODSs that would support the fleet until individual systems were converted or retired from service. It also included 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 nearly 97 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 scheduled for replacement between now and 2015. 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, since Navy policy contains restrictions on the acquisition of equipment utilizing Class II ODSs since the mid 1990s, it is anticipated that Navy shore facilities will be far ahead of 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 2008, the Navy retrofitted over 1,160 shipboard CFC air conditioning and refrigeration systems to non-CFC refrigerants, and returned CFC refrigerant recovered from these retrofits to the Defense Reserve to support remaining 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 E/A-18G, VH-71, F-35, UH-1Y, and AH-1Z aircraft. Developmental testing has been completed on MH-60R/S and P-8A non-halon engine nacelle and auxiliary power unit fire extinguishing systems and certification of these systems for production is expected in the FY09/10 timeframe. The Navy also is working on halon-free fire suppression systems for other new aircraft, including the CH-53K, E-2D, and unmanned aerial vehicles. It is projected that approximately 43,000 pounds of halon will be eliminated in current and future aircraft fire protection systems due to these combined efforts. 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 20 to 35 percent more energy efficient than older CFC systems, contributing positively to Navy's energy conservation and greenhouse gas reduction efforts.

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. The waiver for MCB Camp Butler does not extend beyond December 31, 2010. All Marine Corps installations are expected to transition to non-ODS substitutes or technology by December 2010.

The Defense Reserve 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

Beginning in 1993, the Air Force adopted a centralized, Headquarters-led ODS management program to ensure the appropriate emphasis on the elimination of ODS usage requirements, as technically and economically feasible alternatives became available. During the 1990s, it spent over $500 million 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 remained 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 fiscally and environmentally responsible, maximizing the use of recycled material and minimizing the need to purchase halon at the outset of the Defense Reserve in 1994. Careful centralized management also has ensured that the Air Force has supported its systems while remaining within its original 1994 stockpile, requiring no additional ODS purchases.

The Air Force's centralized management program ensures the responsible use of ODSs in the few mission critical applications that remain and sustain mission capability while promoting environmental stewardship. The Air Force has banned the local purchase of Class I ODSs for almost a decade. In addition, Air Force Headquarters reviews and approves each requisition from the Defense Reserve. These

measures enable close control over Class I ODS use and ensure that personnel are aware of the need to recover, reclaim, and reuse the Class I ODSs in stock. The Air Force maintains these strict controls in peacetime and in combat situations, where Class I ODS consumption can increase.

The Air Force continues to work with government and industry partners to identify and implement Class I ODS alternatives whenever it is technically possible and economically feasible. In 2008, the Navy and Air Force published the results of their joint tests of several commercially available fire extinguishers in an effort to identify a replacement for the 150-pound Halon 1211 flightline fire extinguishers. As first responder protection for the aircraft and their associated combat capability, these fire-extinguishing systems have challenging performance requirements. Of the extinguishers tested, none met the Air Force's flightline fire extinguisher performance requirements. However, the Air Force continues to work with the Navy and industry to find an effective replacement. If successful, this effort would eliminate the largest remaining Air Force ODS use.

Other uses of Class I ODSs remain in existing weapon and facility systems that included 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 the remaining Air Force Class I ODS applications, the primary method of elimination will be through attrition, which is to retire facility and weapon systems at the end of their useful lives and then to replace those systems with new designs that do not use ODSs. For example, the Air Force plans to replace over 2,000 F-15 and F-16 fighter aircraft, which use ODSs in integrated fire and explosion suppression systems, with the F-22 and F-35 aircraft, which do not require the use of ODSs.

Over the last two decades, Air Force organizations have won numerous Stratospheric Ozone Protection Awards. Most recently, EPA recognized Air Force ODS elimination efforts with two "Best-of-the-Best" Stratospheric Ozone Protection Awards in a ceremony held in conjunction with the 20th Anniversary of the Montreal Protocol: one award for the overall Air Force ODS Management program and another for Air Force Research Laboratory's and Aeronautical Systems Center's work on aviation halon replacement.

DLA

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

The Defense Reserve established overseas collection points at DLA distribution depots at Germersheim, Germany; Pearl Harbor, Hawaii; and Yokosuka, Japan; to enhance recycling efforts and to better facilitate Component efforts to turn in excess ODSs. The recovery and reclamation process will continue for the life expectancy of the weapon systems being supported.

In support of environmental concerns within the European Union (EU), the Defense Reserve has established inventory within the bounds of the EU to support its critical weapons systems requirements. Access to those inventories is controlled by the Defense Reserve Program Office in coordination with Military Services. The Defense Reserve has filled all requisitions authorized by the Components to maintain the readiness of U.S. military weapon systems. The Components also have requested the Reserve store a small amount of a hydrochlorofluorocarbon (HCFC-22) for future weapon system needs.

A comprehensive guide for safe decommissioning of nitrogen-charged halon systems, which was developed under the direction of the Defense Reserve, is available on the Internet and is in use by commercial and government concerns worldwide. The Defense 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.

The DoD ODS Reserve Program Office, Defense Logistics Agency, received a 2007 EPA Best of the Best Stratospheric Ozone Protection Award for their contributions in the Netherlands, Australia, United States ODS Management Partnership, which has guided the phase-out of halons worldwide and served as a model of responsible ODS management. The ODS Management Partnership also received the United Nations Environment Programme Partners Award in recognition of their contributions in the global effort to protect the ozone layer. These awards were received at the 20th Anniversary celebration of the Montreal Protocol.