

HCFC Phase-out Management Plan for Iran –UNDP Component

Why is it important?

The issues of ozone depletion and climate change have been at the forefront of the international community's environmental agenda for a number of years now. Man-made chemicals and human activities are having a significant adverse impact on the global climate.

Ozone is a naturally occurring but rare gas - its molecules are made up of three atoms of oxygen (O₃). 90 % of ozone exists in the stratosphere, the upper atmosphere. Although rare, ozone is essential to life on earth. The ozone layer absorbs most of the harmful ultraviolet-B radiation from the sun and filters out lethal UV-C radiation.

The total amount of ozone above the surface of the earth varies with location on timescales that range from daily to seasonal. The variations are caused by stratospheric winds and the chemical production and destruction of ozone. Total ozone is generally lowest at the equator and highest near the poles because of the seasonal wind patterns in the stratosphere.

In 1985, scientists discovered a hole in the stratospheric ozone layer above the Antarctic. This discovery raised concerns amongst the international scientific community. The ozone layer over the Antarctic has steadily weakened since measurements started in the 1980s, and in 2003, the size of the ozone hole peaked at around 28 million square kilometers, making it the second largest on record.

A number of commonly used chemicals have been found to be extremely damaging to the ozone layer. Halocarbons are chemicals in which one or more carbon atoms are linked by covalent bonds with one or more halogen atoms (fluorine, chlorine, bromine or iodine). Halocarbons containing bromine usually have much higher Ozone Depleting Potential (ODP) than those containing chlorine because, atom for atom, bromine (Br) is a more effective ozone-destruction catalyst than chlorine (Cl).

High stratospheric clouds are made up of tiny particles of frozen water, which contain chlorine held in inactive compounds such as hydrogen chloride, hydrochloric acid and chlorine nitrate (at temperatures lower than around -85°C). These compounds do not react with ozone during the darker winter months, but when spring arrives, ultraviolet radiation from the sun acts as a catalyst and causes reactions on the surfaces of the water particles, converting the inactive compounds to reactive chlorine monoxide, which destroys ozone at a very rapid rate. Similar reactions occur with bromine, which destroys ozone at an even greater rate. The human-produced chemicals which have provided most of the chlorine and bromine for ozone depletion are methyl bromide, methyl chloroform, carbon tetrachloride and families of chemicals known as halons, chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs).

Stratospheric ozone depletion is directly related to the issue of climate change. Ozone and some ozone-depleting substances, especially CFCs, are greenhouse gases. Ozone depletion produces an indirect cooling effect, while an abundance of ozone-depleting substances (ODS) results in the warming of the atmosphere. These two climate-forcing mechanisms do not simply offset one another. The interaction between these two processes is more complicated. However, it is well established that the phase-out of CFCs, which have a high global warming potential, has resulted in a significant reduction of CO₂-equivalent emissions. Many CFCs, HCFCs and HFCs being released into the atmosphere manifest themselves as effective greenhouse gases because they absorb infrared radiation going out from the earth's surface. Halocarbons can be much more efficient in absorbing radiant energy than CO₂. Global warming potential (GWP) is used to measure the warming impact of specific chemicals. The GWP is an index comparing the climatic impact of a greenhouse gas with the impact of the same quantity of CO₂ emitted into the atmosphere over a fixed time horizon. As an example, 1 kg of refrigerant emissions (R410A) has the same greenhouse impact as about two tons of carbon dioxide, which is the equivalent of running an average vehicle for 10,000 km.

What is our Goal?

The Montreal Protocol (MP) on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion. The treaty was opened for signature on 16 September 1987, and entered into force on 1 January

1989. The treaty is structured around several groups of halogenated hydrocarbons that have been shown to play a role in ozone depletion. All of these ozone depleting substances contain either chlorine or bromine

hydrochlorofluorocarbons (HCFCs) are compounds that have an ozone depletion potential (ODP) less than 0.2 (relative to CFC-11 which has been assigned an ODP of 1), and are categorized as Class II controlled substances. HCFCs were developed as transitional substitutes for Class I substances and are subject to a later phaseout schedule than Class I substances. Although there are currently 34 controlled HCFCs, only a few are commonly used. The most widely used have been HCFC-22 (usually a refrigerant), HCFC-141b (a solvent and foam-blowing agent), and HCFC-142b (a foam-blowing agent and component in refrigerant blends).

Iran does not produce any HCFCs but imports these compounds for industrial uses. The 19th Meeting of the Parties to the MP in September 2007, adopted an accelerated phase-out schedule for HCFCs. The first control is the freeze on production and consumption of HCFCs from 01 January 2013, at the Baseline Level (average of 2009 and 2010 consumption levels). The other control steps are reduction of 10% by 2015, reduction of 35% by 2020, reduction of 67.5% by 2025, reduction of 100% by 2030, allowance of 2.5% of baseline (annual equivalent) for period 2030-2040 and complete phase out by 2040. Iran is a party to the Montreal Protocol and must comply with the above targets.

How will we reach it?

UNDP activities cover conversion of one systems house - the Urethane System Company (USC) from HCFC-141b to feasible low GWP alternatives and conversion of one domestic air-conditioning manufacturer - the Mehrasl Manufacturing Corporation- from HCFC-22 to R-410A. The project will result in reducing the HCFC consumption from 398.8 Ozone Depleting Potential (ODP) tons in 2010 to 380.5 ODP tons in 2013 and 342.5 ODP tons in 2013.

The bulk of project activities will be implemented in Mehrasl Manufacturing Corporation and include systems and component redesign for manufacturing residential air conditioners using R-410 A. The redesign work will include design and calculations, reengineering of the system components, such as compressors, expansion valves, heat exchangers, etc. as maybe required, prototype manufacturing and test runs. There are also modifications to fabrication and assembly line including corresponding civil and electrical works for: 1) heat exchanger and sheet metal processing; 2) pressure testing equipment; 3) refrigerant charging areas, evacuation and leak detection equipment; and 4) quality inspection, finishing and testing areas. Finally, production personnel will have to be trained to work with residential air conditioners using R-410 technology.

On the other hand, USC will customize their polyol systems mainly focusing on aliphatic compounds (e.g. Methyl Formate, Methyl Al, etc.), Hydrocarbons (e.g., cyclopentane, n-pentane, etc.) and HFOs (e.g. FEA-1100, HBA-2, AFA-L1, etc.) as blowing agents for rigid polyurethane foams. The scope of work shall cover modification of existing facilities

and introduction of new pilot-scale facilities for customization, trials, validation and commercialization of safe, low-GWP, non-HCFC formulations.

What have we achieved?

Since project document signature in January 2012, the project offices have been set-up within the premises of the Implementing Partner, the Department of Environment and staff recruited. The decision on the replacement of gases which are less harmful to the environment is not an easy one for the manufacturers who have been targeted by this project. Technical and sourcing considerations rank high in any major manufacturing decision where a raw material is substituted by another. As a result, the negotiation processes between UNDP and the DoE on the one hand with project beneficiaries on the other have taken some time to conclude. Mehrasl Manufacturing Corporation is currently modifying its fabrication and assembly line based on Memorandum of Agreement that was signed with the DoE in November 2012. Mehrasl Manufacturing Corporation will hopefully conduct its prototype manufacturing and testing by the end of 2013.