

**IMPLEMENTATION OF REGULATION NO. 2037/2000  
CONCERNING THE SUBSTANCES THAT DEPLET THE OZONE  
LAYER, IN MARAMURES COUNTY**

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**Key words:** ozone, ODS, Freon, refrigeration, chlorofluorocarbon, hydro chlorofluorocarbon.

**Abstract.** The ozone layer protection proceeds with representing one of the biggest scientist's pursuits. This „planetary shield” has the UV filtration role which in large amount has a disastrous effect for man and the environment. The main responsible of ozone layer diminution are the halogenated compounds represented by freons, halons, chlorinated solvents, methyl bromide etc, known as ODS<sub>s</sub>. These substances are used in various activity fields like: refrigeration, foams, aerosols, fire fighting, solvents and soil fumigation etc.

**Introduction**

Ozone is a light blue gas, with a pungent smell, made of triatomic molecules, being present in atmosphere in concentration of approximately 0.04 ppm. There is approximately 90% „good ozone” in stratosphere and approximately „bad ozone”10% in troposphere (fig. 1).

The stratospheric ozone represents the protective layer of the Earth, situated at an altitude between 15 and 40 km. It has the role to retain the UV-B radiations from the sunlight. The troposphere ozone situated at lower altitudes (12 km) is toxic for human health and for vegetation (Biggs et al., 1994).

Naturally, the ozone layer suffers a permanent formation and dissociation of molecules through the reactions that take place between the natural compounds containing nitrogen (released by soil and oceans water), hydrogen (resulted from water vapors) and chlorine (released by oceans). These reactions do not destroy the stratospheric ozone layer. The disequilibrium is made by the apparition in atmosphere of synthetic substances from chlorofluorocarbons (CFC), hydro

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chlorofluorocarbons (HCFC), halons, and organic substances with halogens content (CH<sub>3</sub>CCl<sub>3</sub>, CCl<sub>4</sub>, CH<sub>3</sub>Br etc) (Zellner, 1999).



Fig.1 - Atmospheric stratification

The first remarks concerning the reaction results of CFCs with ozone were made by the American savants M. Molina and S. Rowland in 1974.

In 1985 the researchers at British Antarctic Survey discovered a hole in the ozone layer above Antarctic. It was the moment which started the worldwide concern regarding the ozone layer depletion.

The ozone layer refining is more pronounced in winter and spring when the „polar stratospheric clouds” (PSC) favor CFCs decomposition and chlorine releasing. This refining is also intensified by the polar vortex (Biggs, 1994).

### 1. Substances with ozone layer depleting effect

These substances with ozone layer destructive effect are standardized by the Montreal Protocol and are represented by chlorofluorocarbons, other fully halogenated chlorofluorocarbons, halons, carbon tetrachloride, 1,1,1-trichloroethane, methyl bromide, hydrobromofluorocarbons whether alone or in a mixture, and whether they are virgin, recovered, recycled or reclaimed.

These compounds are also known as:

- Freons – represent halogenated derivatives of saturated hydrocarbons used in artificial chill (domestic, commercial and industrial equipments) or as propel agents in cosmetics and pharmaceutical industry. These are very dangerous for environment by their action in depleting the ozone layer

- Halons – there are foams used in fire-fighting equipments.

- Solvents (carbon tetrachloride, methylchloroform) – represent washing-degreasing liquids used in fields like: electronic industry, cleaners, automotive industry etc.

- Methyl bromide –a fungicide used in agriculture.

- Nitrogen oxide and protoxide, carbon monoxide (CO), methane (CH<sub>4</sub>), hydrogen (H<sub>2</sub>) etc.

ODSs are used in the following sectors: refrigeration, foams, aerosols, fire-fighting, solvents and soil fumigation.

## 2. The reactions mechanism of ozone layer depletion

By the chemical composition point of view, freons which are fluorinated hydrocarbons can be divided into three categories (fig. 2):

- CFCs (chlorofluorocarbons), classical freons which contain in their molecule a very instable Cl.

- HCFCs (hydrochlorofluorocarbons), freons called as freons of transition which contain in their molecule hydrogen too, due to Cl is more stable and does not decomposes so easy under UV radiations action;

- HFCs (hydrofluorocarbons), considered as definitive substitution freons, which do not contain Cl in their molecule at all.

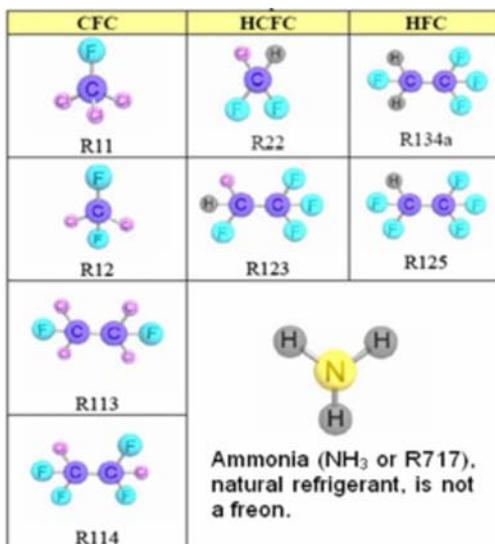


Fig. 2 - Freon categories [15]

These compounds have stable molecules which get to stratosphere where under UV radiation dissociates resulting the free chlorine atom which is very reactive conducting to the ozone decomposing (fig. 3).

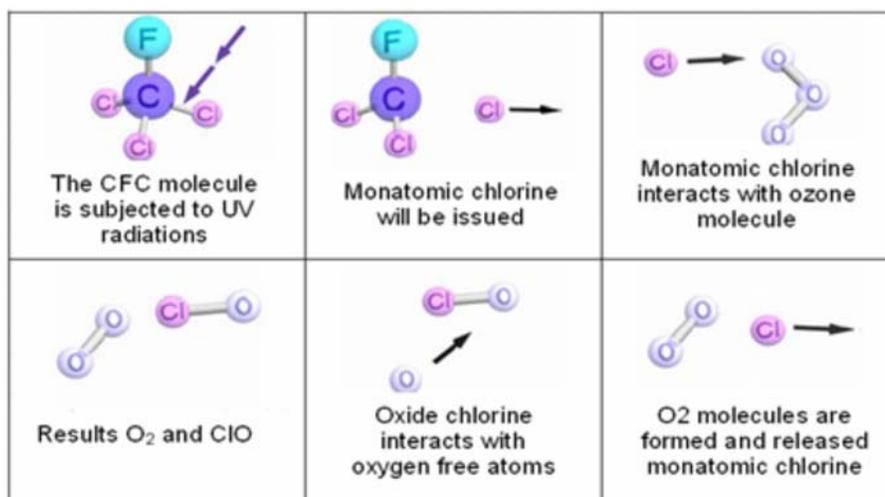
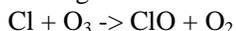
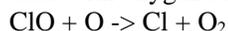


Fig. 3 - The mechanism of ozone layer depletion by Cl atoms from CFC molecules. [15]

The detachment of CFCs molecules releases chlorine which destroy ozone. Thus, chlorine depletes ozone constituting chlorine monoxide and oxygen.



But the chlorine monoxide reacts with oxygen atoms



So, it consumes oxygen atoms which normally conduct to ozone making and releases chlorine which in its turn depletes ozone so that one chlorine atom can destroy many ozone molecules.

### 3. The consequences of ozone layer depletion

The ozone layer depletion can have major and permanent negative effects upon life and environment like:

- Affecting the terrestrial and aquatic ecosystems;
- Changes in atmospheric temperature;
- Decreasing the immune system efficiency conducting to appearance of infections, skin cancer, cataract and even blindness;

- Reducing biomass through ADN destroying in live cells, effects upon trophic chain, inhibition of the oxygen production capacity by the marine phytoplankton, the impact of UV-B radiation upon the sensibilities and activities of the important biological species for the biospherical equilibrium, primary processes (photosynthesis and biosynthesis);

- The increasing of UV-B radiations on photo-degradation of pollutant and chemicals used in agriculture and on other materials, changes in vertical ozone distribution and implicit in atmospheric temperature structure with consequences for climate (Zellner, 1999).

#### **4. The ozone layer protection – legislative aspects**

Romania has made common overtures with other states in order to take the measures referring to this phenomenon. Thus through Law no. 84 from 3 December 1993, Romania adhered to the Convention regarding the Protection of Ozone Layer, adopted at Vienna in 22<sup>nd</sup> of March, 1985 and to the Protocol regarding the Substances that Deplete the Ozone Layer, adopted at Montreal in 16<sup>th</sup> of September 1987 and accept the Amendment at the Montreal Protocol regarding the Substances that Deplete the Ozone Layer, adopted at the second meeting of the Parties at London in 27<sup>th</sup>-29<sup>th</sup> of June, 1990.

As well, Romania has accepted the Copenhagen Amendment in 1992 of the Montreal Protocol, ratified by Law no. 9/2001, the Montreal Amendment from 1997 for Montreal Protocol ratified by Law nr. 150/2001 as well as the Amendment to the Montreal Protocol from Beijing in 3<sup>rd</sup> of December, 1999 approved by Law no. 281 from 5<sup>th</sup> of October 2005. [6,7,9,10,11]

In Romania, the legal framework for ODS<sub>s</sub> phasing out is the Governmental Decision no. 58/2004 for approving the National Program to phase out ozone depleting substances, having as aim the updating on short term of an echeloned and feasible phasing out strategy for the remnant ODS<sub>s</sub> in Romania.

The strategy regarding the substances used in domestic, commercial and industrial refrigerator equipments follows to phase out the refrigerator equipments which use CFC (CFC12, CFC11 etc) and to replace them with equipments that use HCFC<sub>s</sub> or other non ODS agents (HFC 134a, HFC 600a, ammoniac etc.) [4]

The regimes of the substances that deplete the ozone layer (ODS<sub>s</sub>) has been regulated by Law no. 159/2000 and once with Romanian adherence at European Union in order to manage the substances that deplete the ozone layer, the Regulation no. 2037/2000 has been applied without transposing. It refers to the production, import, export, trading on the internal market, using, recovery, recycling, regeneration and destruction of the substances that deplete the ozone layer.

### **5. Provisions of Regulation no. 2037/2000.**

In Regulation no. 2037/2000 there are stipulated the terms for consumption and phasing out of the substances that deplete the ozone layer, specific to the phase out scheme for the developed countries and there are provided data concerning the CFC<sub>s</sub> and HCFC<sub>s</sub> consumption in 1989 in order to align at Annex III of this regulation.

The regulation introduces specific terms for the chemical substances contained in the Montreal Protocol annexes as well as requirements about monitoring and reporting of the activities with chemical substances from this category.

Priorities in implementing the Action Plan identifies the content of the national program to eliminate ozone depleting substances, updated, approved by GD no. 58/2004.

According to the Regulation, CFC production stopped in Romania since 1995 and production capacity of HCFC does not exist anymore. After December 31, 2009 is prohibited placing on the market by importers of HCFC<sub>s</sub> sites. It also prohibits, with certain exceptions, the import and placing on the market of products or equipment containing chlorofluorocarbons, other fully halogenated chlorofluorocarbons, halons, carbon tetrachloride, 1,1,1-trichloroethane and hydrobromofluorocarbons.

Within Law no. 159/2000 the production, trading and using of CFC<sub>s</sub> from the category "other CFC<sub>s</sub>" are prohibited.

The National Action Plan provides for updating the system for issuing the environmental agreement, by replacing it with the procedure of issuing a "license" to import/export of ODS<sub>s</sub>.

Fields of activity covered by Regulation no. 2037/2000 - priority measures:

1. Refrigeration sector:

- Implementation of the Emergency Ordinance no. 89/1999 on the need for certification of personnel performing service on refrigeration equipment (domestic, commercial and industrial) as well as air conditioning equipment.

2. Duty operators providing service activities on refrigeration equipment to hire qualified staff.

3. Solvents sector:

- The use of solvents in the category of ozone depleting substances in open systems for cleaning/degreasing is prohibited;

4. Applications in agriculture:

- Since 2002, the use of methyl bromide in soil fumigation applications is prohibited and also since 2005, in storage applications, except for quarantine and pre-shipment cases, according to Law nr.159/2000.

▪It is necessary to achieve inventory applications of methyl bromide for quarantine or for any cases of shipping treatment plant products.

5. Fire -fighting sector:

▪Issuing the inventory of the fire-fighting installation capacities that use halons and assuring the management of halons in installations as required by Regulation.

*ODS<sub>s</sub> management in Maramures County in 2008.* In Maramures County, as a result of ODSs inventory made by EPA of Maramures County, as part of the national inventory realized in order to report it to the European Commission, the following have been found out:

- have not been identified automatic fire-fighting equipment to be supplied with halon 1211 or halon 1301;
- no stocks of methyl bromide or businesses that use methyl bromide in vegetal protection applications;
- have not been identified uses of carbon tetrachloride in industrial activities
- have not made imports of refrigerants and foaming agents.

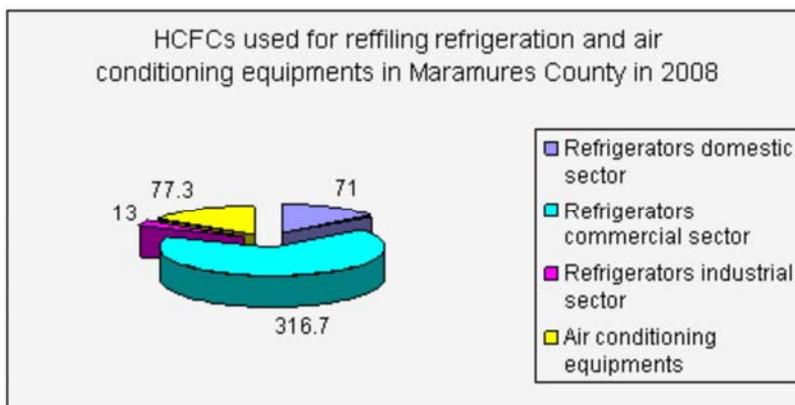


Fig.4 - HCFCs used for refilling refrigeration and air conditioning equipments in Maramures County in 2008

After updating the ODS database, it was found that in Maramures County there are no manufacturers, importers or exporters of controlled substances of the Montreal Protocol.

As required by Regulation 2037/2000, since January 1, 2010, prohibits the use of hydrofluorocarbons new products to the maintenance and servicing

refrigeration and air conditioning available at that time and since 2015 all hydrochlorofluorocarbons shall be prohibited.

Following the freons inventory that the refrigeration operators have used in their work in 2008, there was a decrease in the used quantities compared with 2007.

Most of the quantity of HCFC 22 (316.7 kilograms) was used in the service for refrigerators and air conditioners and especially for refilling of refrigeration equipment in the commercial sector (Fig. 4). Also, HCFC 22 was most used in service activity for refrigeration equipments in the domestic sector (71 kg) and air conditioning installations (77.3 kilograms). For industrial refrigerators much lower amounts of the Freon (13 kg) were used. [13]

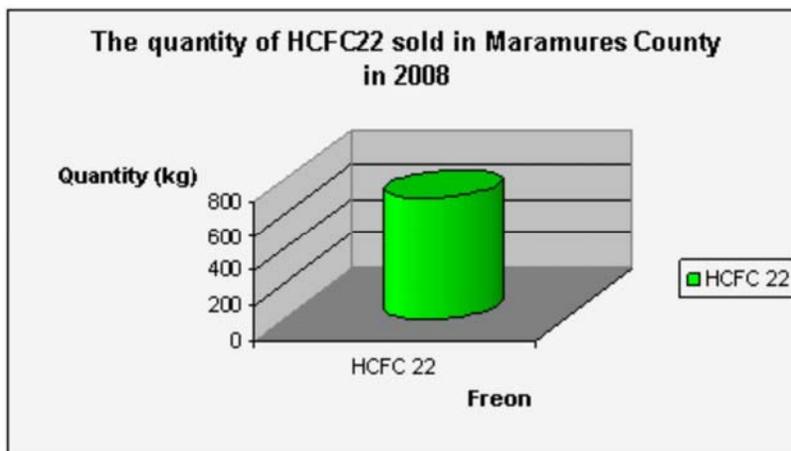


Fig. 5 - The quantity of HCFC 22 sold in Maramures County in 2008

No recoveries were observed following the intervention of refrigeration operators to provide the service to refrigerators and air conditioning.

Also in northern Maramures County, in 2008, was sold a quantity of HCFC 22 of 694 kg (fig. 5).

Following the inventory of substances used in refrigeration businesses in 2008, the work of service in various refrigeration equipment and air conditioning, in Maramures County for 2008 have not found the use of chlorofluorocarbons, halons, carbon tetrachloride, 1,1,1 - trichloroethane and hydrobromofluorocarbons or other substances prohibited by Regulation 2037/2000.

Also, in accordance with the provisions of Regulation 2037/2000 a legislative informing and dissemination activity was carried on concerning the duty

of the refrigeration operators to possess certificates and recovery equipment for the used freons as well as related to the recycling centers where the recovered Freon amounts could be sent. [8.13]

The priority measures concerning reporting and monitoring of ODSs in Maramures County refer to:

- Annual update of the inventory operators and applications that use chemicals that deplete the ozone layer until April 1<sup>st</sup> of each year.
- Compliance with the provisions of legislation relating to reporting obligations incumbent operators on the quantities of ozone depleting substances used annually and applications for which they were used.

### **Conclusions**

Romania is one of the countries that took issue with depreciation on the ozone layer in harmony with the conventions to stop the phenomenon of degradation of "planetary shield" that protects us biologically harmful ultraviolet radiation. Our country has strengthened the institutional and legislative framework to meet international standards in legislation to reduce and eliminate emissions that have the ability to destroy stratospheric ozone.

By the application of the Regulation no. 2037/2000 on substances that deplete the ozone layer, at the county level, it contributes to national and global effort to reduce the disastrous effects that the substances covered by the Montreal Protocol have on stratospheric ozone.

With the support of European Commission and the Multilateral Fund, Romania has made legislative efforts, has identified projects to encourage industry to use chemical compounds without the least injury or harm to the ozone layer, has established training centers and training of staff with responsibilities in the field of refrigeration, replacement, recovery and recycling of Freons from appliances and equipments.

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- Regulamentul Parlamentului European și al Consiliului (CE) nr. 2037/2000** din 29 iunie 2000 privind substanțele care depreciază stratul de ozon

**LEGEA Nr. 84 din 3 decembrie 1993** pentru aderarea Romaniei la Conventia privind protectia stratului de ozon, adoptata la Viena la 22 martie 1985, si la Protocolul privind substantele care epuizeaza stratul de ozon, adoptat la Montreal la 16 septembrie 1987, si pentru acceptarea Amendamentului la Protocolul de la Montreal privind substantele care epuizeaza stratul de ozon, adoptat la cea de-a doua reuniune a partilor, de la Londra, din 27-29 iunie 1990;

**LEGEA nr. 150 din 6 aprilie 2001** pentru acceptarea Amendamentului la Protocolul de la Montreal privind substantele care epuizeaza stratul de ozon, adoptat la cea de-a IX-a reuniune a partilor, la Montreal, din 15-17 septembrie 1997

**LEGEA nr. 159 din 3 octombrie 2000** pentru aprobarea Ordonantei Guvernului nr. 89/1999 privind regimul comercial si introducerea unor restrictii la utilizarea hidrocarburilor halogenate care distrug stratul de ozon;

**LEGEA nr. 281 din 5 octombrie 2005** pentru aprobarea Amendamentului la Protocolul de la Montreal privind substantele care epuizeaza stratul de ozon, adoptat la Beijing la 3 decembrie 1999

**ORDONANTA nr. 24 din 27 ianuarie 2000** pentru acceptarea Amendamentului la Protocolul de la Montreal privind substantele care epuizeaza stratul de ozon, adoptat la Copenhaga la 25 noiembrie 1992;

**Protocolul din 16 septembrie 1987 de la Montreal** privind substantele care epuizeaza stratul de ozon

<http://www.ecosit.ro/articol/98/ozonul/>

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