The ministry of preservation of the environment of Republic Kazakhstan

THE REPUBLICAN STATE ENTERPRISE «THE KAZAKH SCIENTIFIC RESEARCH INSTITUTE OF ECOLOGY AND THE CLIMATE»

UDC 551.510.534(574).621.594
№ state registration

I CONFIRM
The vice-minister
Preservations of the environment
Republic of Kazakhstan
_____ M.A.Turmagambetov
«___» _____ 2010

THE REPORT
ABOUT RESEARCH WORK

On a theme:
ESTIMATION OF MODERN DEVELOPMENT OF SECTORS OF CONSUMERS OZONE DEPLETION SUBSTANCES AND THEIR INFLUENCE ON THE OZONE LAYER AND CLIMATE CHANGES. POSSIBILITIES OF ADAPTATION OF SECTORS TO THE MEASURES ACCEPTED FOR PERFORMANCE OF OBLIGATIONS UNDER THE MONTREAL REPORT ON SUBSTANCES, DESTROYING THE OZONE LAYER
(The third stage, final)

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Almaty 2010

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THE ABSTRACT

The report 73 with., 38 fig., 7 tab., 74 sources of the literature
OZONE DEPLETION SUBSTANCES, THE OZONE LAYER, TROPOSPHERIC OZONE, GROUND OZONE, THE MONTREAL REPORT, THE VIENNESE CONVENTION, THE KIOTSKY REPORT, THE INDIRECT GREEN HOUSE EFFECT, THE DIRECT GREEN HOUSE EFFECT, CARBON DIOXIDE, ODSs and CFC substitutes, BROMIC METHYL, SUBSTANCES OF THE APPENDIX C.
Object of research are - a quantitative estimation of direct and indirect emissions (green house and ozone depletion influences) ozone depletion substances (ODS) within the limits of obligations Republic of Kazakhstan (RK) under the Montreal report at a transition stage to alternative substances.
The work purpose – Studying of time dynamics of the general maintenance of ozone over Kazakhstan to estimate taking place tendencies. Whenever possible to specify their origin

- To Reveal aerosynoptic conditions at which extreme concentration of the general ozone take place.
- To state an influence estimation ozone depletion, consumed in Kazakhstan, on an ozone layer and on a climate. To estimate share HFC in total amount consumed , ODSs and CFC substitutes in Republic.
- The Analysis of measures undertaken by the developed countries on reduction of emissions ozone depletion substances in various branches of economic activities.
- The Estimation of the undertaken efforts of directing bodies PK on reduction of emissions in atmosphere ODSs, and an estimation of consequences.

In the course of work researches of influence ODSs, on an ozone layer, communications ODSs with climate change, dynamics of emissions ODSs were conducted, a quantitative estimation of a hotbed effect and ozone depletion influences during 1998-2008, the forecast of consumption for the period till 2015 is given.
As a result of the executed researches level of direct and indirect emissions ODSs, in CO2 – an equivalent and its dynamics to 2008г is estimated., the forecast of consumption ODSs till 2015 in connection with transition to alternative sources is given. It is shown that despite consumption growth hydrofluorocarbons in Republic Kazakhstan direct and indirect influence on atmosphere tends to decrease.
Dynamics of the general maintenance of ozone, tropospheric and ground ozone are studied. aerosynoptic conditions of formation of their extreme concentration.
Results of research promote the decision of following problems:
- To quantitative and qualitative acknowledgement of success of performance of the obligations accepted by Republic Kazakhstan according to the Montreal report;
- To preparation of national reports of Republic Kazakhstan under the Montreal report and the Viennese convention;
- Our knowledge in the field of geoecology of formation and dynamics of ozone is expanded.

THE LIST OF REDUCTIONS, SYMBOLS, UNITS AND TERMS

Reductions

BrM Bromic methyl Gross national product The Total internal product
ICLLC Influence on a climate during life cycle
HCFC hydrochlorofluorocarbon
HFC Hydrofluorocarbon
HS The Harmonized system
GTRЭEE Group under the technical review and an economic estimation
HCFCГХФУ Hydrochlorftorcarbon
GEF Global ecological fund
HFC hydroftorcarbon
Кт Kilotons
EFFICIENCY Efficiency
MB Metilbromid
Мт Metric tons
MOPE The Ministry of preservation of the environment
MCF Metilchloroform
MR The Montreal report
UN The United Nations
UP Usual practice
ODSs Ozone depletion of substances
ODP Ozone depletion power
PS polluting substances
GMO The General maintenance of ozone
GH Green house gases
PGW Potential of global warming
PD UN The Program of development of the United Nations
RK Republic Kazakhstan
RI Radiating influence
SC The Stationary air conditioning
COEUTEE The Commission of experts under the technical review and an economic estimation
TCM Tetrahclormetan
HC Hydrocarbon
CFC Chlorftorcarbon
FCC Four-chloride carbon
UNPPE The United Nations Program on preservation of the environment

SYMBOLS AND UNITS OF PHYSICAL SIZES

T.ODP	Tons ODP	Ozone depletion power
^{0}C	Celsius degree	
Thousand tons	One thousand tons	
B. Tenge	Billion tenge	

Chemical formulas

About	Atom of oxygen
O2	An oxygen molecule
CO	carbon oxide
CO2	Carbon dioxide
CH4	Methane
N2O	Nitrous oxide

INTRODUCTION

About 40 years ago it was revealed that hydrochlorftorcarbons, used in the industry, especially intensively – in refrigerating branch, destroy an ozone layer of the Earth. The intensive scientific researches which have begun in those years in the field of atmospheric chemistry have allowed to reveal at once some types of the chemical reactions leading to destruction of an ozone layer. As it is known, the basic quantity of ozone is at heights of 22 km or a little above [9, 31, 34]. Hydrochlorftorcarbons, having, as a rule, long term of a life, rise in an upper atmosphere and enter reaction with ozone, destroying it. Thus hydrochlorftorcarbons. do not collapse almost that has led to their fast enough accumulation in atmosphere and to acceleration of process of destruction of ozone [15, 16, 22, 23].

Ozone absorbs a considerable part of ultra-violet radiation of the Sun, protecting, thus, all live on the Earth, and simultaneously heating up corresponding layers of a stratosphere, i.e. an atmosphere part. Destruction of atmospheric ozone by hydrochlorftorcarbons, hence, conducts to cooling influence on atmosphere. However hydrochlorftorcarbons have own strips of absorption in an infra-red range of a spectrum and are, therefore hotbed gases. The majority of hydrochlorftorcarbons have on atmosphere double influence: destroying an ozone layer, cool it, but absorbing leaving long-wave radiation of the Earth and atmosphere, heat up it. The second effect – heating of atmosphere is much stronger, than cooling [20, 29].

Ozone layer destruction is extremely serious problem for mankind. Therefore a number of the international agreements on curtailment of production and uses especially aggressive hydrochlorftorcarbons and to replacement search by other substances (this question has been considered at the first stage of performance of a theme) has been accepted.

In connection with the above-stated in the given work dynamics of the general, tropospheric and ground ozone is comprehensively considered, aerosynoptic conditions of formation of extrema of their concentration are studied.

Time dynamics of concentration GMO is studied and bases for working out of corresponding methods of forecasting are put. For this purpose mathematical models EMEP of the centres the West and the East have been studied also and the binding of results to the Kazakhstan data is carried out.

The Viennese convention on protection of an ozone layer of 1985 was the first international document putting a problem of preservation of an ozone layer of the Earth. This document, inherently, had declarative character. The states which have signed him did not incur any obligations; contours of a universal problem which followed as soon as possible have been only outlined solve. However has passed hardly more than two years, and in 1987 the international community has accepted much more rigid document which has received the name the Montreal report on substances, destroying an ozone layer. According to its positions, the basic originators of destruction of an ozone layer by atoms of chlorine or bromine which have separated from molecules of the chemical compounds synthesised by the person [15, 16, 19, 22, 23] appeared.

The basic fault was taken away by hydrochlorftorcarbons, used as sprays in aerosols, and to coolants, including well-known R12 by which the overwhelming majority of refrigerators and conditioners in those days has been filled. Despite protests of not numerous groups of the authoritative scientists specifying in insufficient scientific validity of positions of the forthcoming contract, the Montreal report has been accepted, and the group of the chemists which have prepared scientific base under this interdiction, has been awarded the Nobel Prize [29, 32, 33].

Till now some researchers express the big doubts concerning expediency of acceptance of an interdiction hydrochlorftorcarbons. The most rigid critics declare the report the grandiose swindle initiated by group of chemical concerns, on purpose to monopolise the market and to supersede national manufacturers, more moderate - speak about argumentativeness of some positions and call for updating of the report taking into account time.

Kazakhstan ratified the Viennese convention on protection of an ozone layer and the base Montreal report on the substances destroying an ozone layer [15].

The general obligations of the parties of these international nature protection agreements consist in the following. The parties of the Viennese convention undertake to protect health of the person and environment from the influences connected with an exhaustion of an ozone layer. The Montreal report to the convention contains schedules of stage-by-stage decrease in manufacture and consumption, the most important in the ecological and commercial relation ozone depletion substances (ODSs), measures of regulation of their manufacture, export and import [15, 16, 18, 30].

The Report parties found commissions of experts by scientific, ecological and technical and economic estimations. In process of receipt of the new information from these groups about influences on an ozone layer, the world network of supervision based on the data behind the ozone maintenance in atmosphere and its chemical compound, researches of properties OPB and occurrence of alternative substances and technologies, the Parties included in it new substances and strengthened requirements of the Report by acceptance of additions and amendments (London, 1990, Copenhagen, 1992, Montreal, 1997, Beijing, 1999).

In spite of the fact that after introduction of amendments and toughening of schedules of deducing from the reference of adjustable substances the Montreal report has taken very difficult form, it is recognised by most successful of nature protection international agreements. Thanks to the measures of regulation installed by its parties by 2000 world production ozone depletion substances, already it was reduced more than on 85 % in comparison with level of 1986 almost all countries of the world ratified the Montreal report that speaks about importance of participation in this agreement.

Now 27 countries-parties of the Montreal report including Kazakhstan, are carried to the countries with transitive economy. Process of transition of economy to the market relations, carried out by these countries, causes serious difficulties in performance of their obligations under the Montreal report and ratification of amendments to it. Difficulties consist, basically, in absence in these countries of financing for realisation of projects on reduction of consumption ODSs, a lack of the prepared shots and the information in the field of technical alternatives ODSs институциональных and language barriers.

The control over performance of the Montreal report is in conducting UNPE (United Nations Programs on environment). UNPE supports work of Ozone Secretary which (Kenya) is in Nairobi, is executive agency of the financial mechanism of the Montreal report - Multilateral Fund and Global Ecological Fund [15, 16, 19].

For today the total sum of the financial help on realisation of actions for reduction ODSs, rendered to the countries with transitive economy Global Ecological Fund, comes nearer to 200 million US dollars.

Kazakhstan as the country which has joined the Montreal report and other agreements both on protection of an ozone layer and to the Kioto report on measures directed on reduction of emissions of hotbed gases, keeps account consumption hydrochlorftorcarbons in the country and tries to predict such consumption, and also to estimate size of a hotbed effect at the expense of emissions hydrochlorftorcarbons [16, 35-38].

Particularly at the third stage following problems have been put:

1) Studying of time dynamics of the general maintenance of ozone over Kazakhstan, an estimation of its tendencies and an origin;
2) To Reveal aerosynoptic conditions at which extreme concentration of the general and ground ozone take place;
3) To state an influence estimation хладонов, consumed in Kazakhstan on an ozone layer and on a climate. To estimate длю ГФУ in total amount consumed хладонов in Republic
4) To make the analysis of measures undertaken by the developed countries on reduction of emissions ozone depletion substances in various branches of economic activities.

The decision of the problems set forth above, according to the Technical specification on theme performance (Appendix A) also is the maintenance of the given Report.
Tasks in view are completely executed, and results are presented in the given report.

1. OZONE IN ATMOSPHERE

1.2. An annual course of the general maintenance of ozone.

The annual course of the general maintenance of ozone at stations of Kazakhstan where it is measured, is very simple and presented on fig. 1. Mans average sizes GMO for the same stations are resulted in table 1.

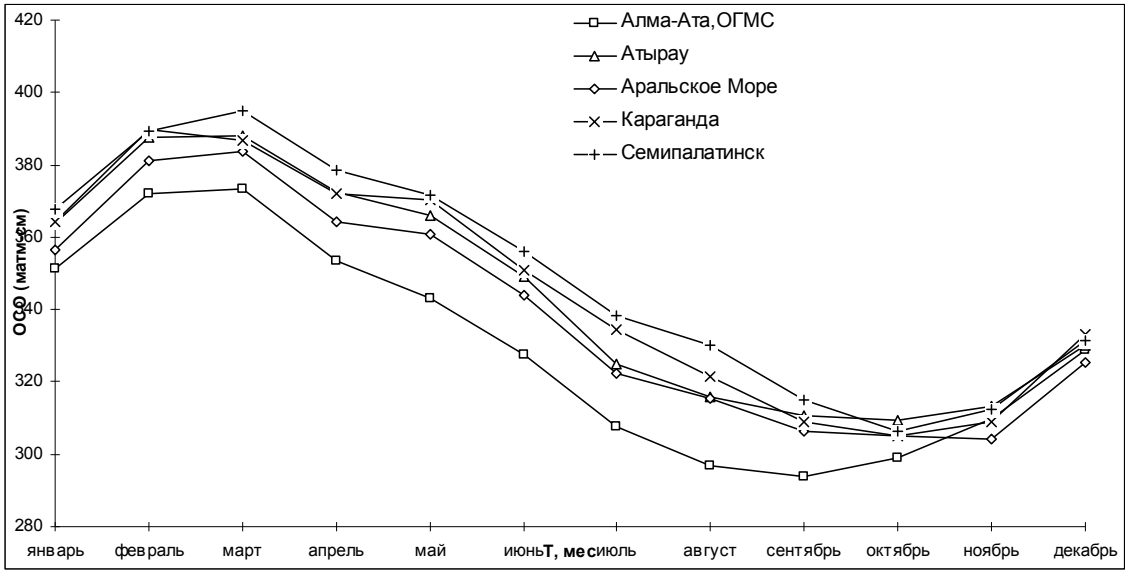

Fig. 1 Annual course of the general maintenance of ozone at stations of Kazakhstan from 1973 for 2006

It is possible to see that annual course GMO is very simple and similar at all stations of Kazakhstan. It has one maximum in March and a minimum in September. However, in separate years the maximum can move for February, and a minimum for October.
In an annual course it is well looked through following dependence: the to the south the station, the is less GMO in a maximum and as a whole within almost all year except for the minimum period. On this time site of size GMO are very close also dependence on width it is broken. The station Semipalatinsk though is located a little to the south of Karaganda, but it is considerably shifted to the east where the local maximum of ozone [30] takes place.
In a maximum average sizes GMO change from 395 ODSs for Semipalatinsk to 373 ODSs for Almaty. In a minimum the range of change is less: from 309 ODSs for Atyrau in October to 294 ODSs for Almaty in September. Thus, the amplitude of annual course GMO makes 75-80, i.e. 30-35 % from an average for a year.

Table 1
Long-term average monthly values GMO (ODSs)

MS	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Alma-Ata	351	372	373	353	343	328	308	297	294	299	310	329
Атyrau	364	388	388	372	366	349	325	316	311	309	313	330
Aral sea	357	381	384	364	361	344	322	315	306	305	304	326
Karaganda	364	390	387	372	370	351	335	321	309	305	309	333
Semipalatinsk	368	389	395	378	372	356	338	330	315	306	312	331
AVERAGE	**361**	**384**	**385**	**368**	**362**	**346**	**325**	**316**	**307**	**305**	**310**	**330**

Against enough simple as it is told above, annual course GMO, characteristic Kazakhstan for all stations, most poorly this minimum is looked through on a curve of course GMO for Almaty. Thus, an annual course and features of spatial distribution GMO over territory of Kazakhstan as a whole correspond to the theory and results of researches of ozone [37, 39, 40, etc.].

1.3. Tropospheric ozone

As tropospheric ozone appears as a result of "infiltration" of stratospheric ozone through тропопаузу it is natural to expect that its annual course will be definitely caused by a course of stratospheric ozone. And stratospheric ozone, or the general maintenance of ozone (GMO), has the expressed simple annual course with one maximum and one minimum. The maximum takes place in the end of winter or in the beginning of spring. In a zone 45-50n.b. It is necessary on the beginning of April. The maximum at all widths of a moderate strip is distinct.
Minimum GMO on the contrary flat also "is smeared". It can come in September-October (about 50 % of stations of Northern hemisphere) either in November-December or in August, i.e. the period from August till November of size GMO are insignificant and can change from a month by a month.
Amplitudes of annual course of GMO in the north exceed of 200 Dobson units, and in moderate widths – 100 ODSs.
In table 2 the annual course of size of tropospheric ozone over Kazakhstan in terms of Dobson u. on the basis of satellite measurements during 2005 [25] is presented. For simplification of the analysis in the table the data about tropospheric ozone in adjacent territories for the same year is cited.

Table 2.
Average sizes of tropospheric ozone at stations of Kazakhstan (D.units).

Станции	Months												The Sum	Compare stations year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Alma-Ata	15	20	20	30	25	35	50	40	33	20	20	20	328	27,3
Атyrau	27	30	28	24	30	28	35	30	23	20	20	30	326	27,1
Aral sea	26	35	30	22	25	30	40	36	25	22	25	20	336	28,0
Karaganda	17	26	25	24	22	32	40	36	23	20	20	20	305	25,4
Semip-sk	15	28	23	20	30	35	43	30	22	20	17	17	300	25,0
Kazakhstan	20	28	25	24	26	32	42	34	25	20	22	20	1595	26,6

It is possible that in general an annual course of tropospheric ozone to see much more difficult, than annual course GMO. The basic maximum of tropospheric ozone in territory of Kazakhstan

is necessary for July. This maximum is well expressed in Republic territory though at some stations of adjoining territory it takes place in August or June (Chardzhou, Dushanbe, etc.). The maximum in a time course there is more stretched in time.
However, in an annual course of tropospheric ozone unlike GMO is available two minima and two maxima. The second, or the secondary maximum is observed in February, and at some stations of adjoining territories, in March. Accordingly, the secondary minimum takes place in April-May. Both the secondary maximum, and a secondary minimum are expressed accurately and short in time. It is obvious that the secondary maximum in February-March and the basic minimum in September-November coincides with extrema during stratospheric ozone. As to the basic maximum of tropospheric ozone in July it is caused active thermal конвекцией in this season and destruction of tropopauze over the south of Kazakhstan in summertime [30] that facilitates receipt in troposphere of atmospheric ozone.
The basic minimum of tropospheric ozone is observed simultaneously with minimum GMO in atmosphere and, probably, is its consequence.
As to a secondary maximum of tropospheric ozone in February (sometimes in March) it coincides on time in due course approaches of maximum GMO. And this factor explains its existence. The approach explanation, however, a secondary minimum of tropospheric ozone in April-May demands additional researches. Probably it is result of strengthening an meridional exchange in which result on territory of Kazakhstan air of tropical widths arrives, poor ozone, and the mechanisms providing receipt of ozone from a stratosphere, are still insufficiently effective at this time. They amplify only by July.
Thus, in an annual course of tropospheric ozone two maxima and two minima take place. The basic maximum takes place in July, and it is caused intensive turbulent and by convection an exchange on a vertical, and also easing тропопаузы, as detaining layer, by this time. The secondary maximum in February-March coincides on time with minimum GMO and, probably, by it is caused. And maximum of GMO comes in connection with activization of the general circulation of atmosphere and carrying out in system of hollows of the cold air rich with ozone from high widths.
The basic minimum of tropospheric ozone is caused by a minimum of stratospheric ozone which comes during the period from September till November. The secondary minimum in April-May is caused by change of carrying out of the cold air weights rich with ozone, from high widths, on carrying out of warm air weights from the south, poor ozone. The annual course of tropospheric ozone appreciably defines a course of concentration of ground ozone.

1.4 Ground ozone (GO)

1.4.1 Annual course of ground ozone

The basic drain of atmospheric ozone, as it is known, are a ground layer and an earth surface where it filters. Therefore the quantity of ground ozone is defined on the one hand by its infiltration from an upper atmosphere (from a stratosphere), and with another – speed of its destruction in a ground layer and at the earth. The best conditions for ozone receipt in a ground layer are such when are developed convection, turbulence, and also the ordered movings of air on a vertical. Such conditions are created during the spring-and-summer period. In the winter for the majority of regions of Kazakhstan, except absence of conditions for intensive convection and turbulence presence of ground inversions or izostratas, interfering ozone receipt in a ground layer is characteristic. It causes in an annual course of ground ozone a maximum during the summer period and a minimum – during the winter period, May and December-January accordingly. Thus the amplitude of its annual course is great: From 0,01 mkg/m3 in the winter to 0,16 mkg/m3 in the summer, i.e. summer average concentration exceed winter at 10-15 time. On fig. 2 the annual course of ground ozone is presented to Almaty for the three-year period.

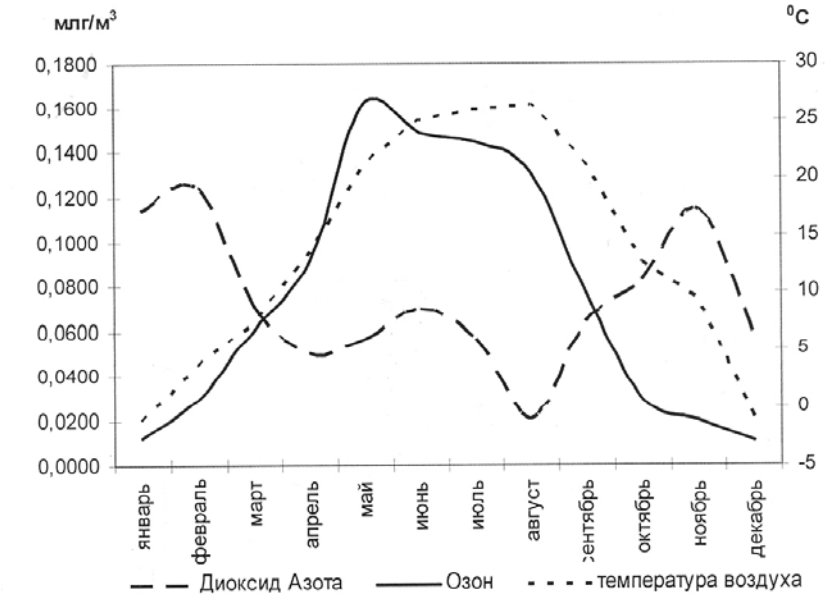

Fig. 2 Annual course of the ground maintenance of ozone in Almaty.

As speed of destruction of ground ozone depends on concentration of nitrous oxide on the schedule fig. 2 is put also a course of average concentration of this substance. Besides, on the schedule are put, also the monthly average temperatures of air, characterising conditions thermal convection and turbulence.

It is possible to see that from winter by the summer the curve of change of concentration of ground ozone in general repeats a course of temperature of air. Since August, however, concentration of ozone decrease much faster, than air temperature decreases. It is caused by that in the end of summer and in the autumn for region carrying out of warm air weights from Arabian peninsula and from Afghanistan, poor, as it is known, ozone [30] is characteristic. As a result, despite quite intensive hashing on verticals, ozone receipt in the ground layer decreases faster, than there is a decrease in temperature of air.

Annual course of concentration of dioxide of nitrogen returns to an annual course of concentration of ozone. The minimum of dioxide of nitrogen is observed in August, and a maximum - during the winter period that is quite explainable. The basic sources of emissions nitrogen dioxide are the power enterprises, and also motor transport. Emissions of the power enterprises are maximum during winter time and are minimum in the summer. In August also the quantity of cars in a city in comparison with spring is less and considerably decreases in the autumn. Hence, to see effect of destruction of ozone emissions of dioxide of nitrogen it is not obviously possible, at least at level of monthly average sizes.

The particular interest is represented by low concentration of ozone to the winter period. Over the southeast of Kazakhstan at this time the spure of the Siberian anticyclone promoting to formation enough of powerful ground inversions almost constantly settles down. Repeatability of such inversions in Almaty exceeds 70 % [46, etc.]. As a result receipt of ozone from the top layers from troposphere is complicated, and process of its destruction in a ground layer takes place. Against such general feature, characteristic for winter, in separate days depending on aerosynoptic conditions of concentration of ground ozone can strongly increase.

1.4.2. A daily course of ground ozone

As ground ozone makes direct impact on the person the great attention was always given to its research. The particular interest has presented its daily course. Still in [41] it has been shown that features of a daily course are connected with ozone distribution in a ground layer and processes of carrying over and destruction of ground ozone. The author [41] believes, hence, that daily

changes of ground ozone are a consequence of a vertical exchange in weights of air. And only in the winter at strongly weakened exchange the second factor – «air pollution by a smoke and other, destroying ozone a layer» comes into force. In the same place it has been shown that the absolute and relative amplitude of a daily course of ground ozone increases in the summer about to 20 % from an average and decreases in the winter. The amplitude is insignificant in a seaside climate and on heights in the winter. The maximum of density of ozone comes usually soon in the afternoon, and a minimum – in the morning during sunrise. In the summer the maximum often moves on 16-17 h. local time.
The researches executed by different authors the next years, have deepened and have expanded our knowledge of a daily course of ground ozone, but the basic results stated in [30], have been confirmed.

1.4.3. A daily course of ground ozone in Almaty

In table 3 the basic characteristics of a daily course Ozone in Almaty in median months of seasons of year are placed.
Table 3
Sizes of ground ozone over Alma-Ata (mkg/m3)

Months	Characteristics	The Average				Terms Year
		01	07	13	19	
January	An average	5	7	15	2	7
	max	74	83	51	25	-
	min	0	0	0	0	-
April	An average	108	10,5	227	85	132
	max	274	301	488	240	-
	min	3	3	50	0	-
July	An average	201	168	359	221	238
	max	433	341	677	450	-
	min	20	31	55	37	-
October	An average	38	37	172	19	94
	max	226	173	342	123	-
	min	0	0	0	0	-

It is possible to see that the daily course of ozone in Almaty essentially differs from the results containing in [41], etc. for plains. The general is that during all seasons of year the maximum of ground ozone takes place at 13 o'clock local time. Thus average concentration from January (minimum) by July (maximum) increases in 20 times, it is essential more than sizes of annual amplitudes to Europe and the North America. The reason of it are the powerful ground inversions caused by influence of a southwest spur of the Siberian anticyclone, observed during all cold period, Inversions interfere with receipt of ozone from troposphere, therefore in the winter a minimum Ozone especially deep.
The ozone minimum in January-April and October in a daily course takes place not in the morning, and in the evening at 19 o'clock. Only in July its minimum is observed in 7 o'clock in the morning. Almaty it is located in foothills of Zailijsky Ala Tau in a zone it is mountain-valey winds [47]. In [42] it has been shown that at the Antarctic coast local winds essentially deform a daily course Ozone. Influence of such winds also forms a daily course.
From a maximum at 13 o'clock concentration Ozone quickly go down by 19 o'clock at the expense of easing convection, turbulence, and also the beginning of formation of the ground or raised inversion which takes place and at any time year, though also the nature at it another. Even with a sunset and cooling of mountains there is a mountain wind. As it is known [8, 9], in

an interface during the cold period at height about 500-1000 m the ozone maximum in its vertical distribution takes place. Here the mountain wind, promotes lowering of air weights along mountain valleys and slopes and enriches ozone the bottom layers. It absence of a minimum of ozone in 07 o'clock in cold months and its presence – in warm also speaks. Thus in June-August this minimum is especially deep. Small falls of concentration of Ozone in 07 o'clock are observed in April and October. In the end of April and the beginning of October of a condition is closer to summer, than to the winter. Therefore we can observe this weak secondary minimum. The similar explanation of a daily course at coast of Antarctica where are observed local стоковые winds, contains in [30, 42], etc.

How does concentration of ground ozone within days strongly vary? According to [8, 9] daily fluctuations of Ozone are in limits + 20 % from an average. It is possible to see that in Almaty in January the daily course of average sizes of ozone makes 100 % from an average towards a maximum and 300 % towards a minimum, in June – 50 and 30 %, in April – 80 and 40 %, in October – 90 and 450 % accordingly. Hence, speed of change of ground concentration the least in July, in the winter, and during transitive seasons it above.

In table 3 extreme values or extrema of Ozone, observed within months of certain seasons are resulted also. In January and also in April and October the bottom values of Ozone are defined by sensitivity of the device. In January in terms 01, 07, 13 and 19 o'clock 18, 13, 4 and 18 cases when the device showed zero concentration of Ozone have been registered. In April and July of such cases was not, and in October they have made 9, 7, 0 and 11 accordingly on terms. April and October, hence, despite approximate similarity radiation conditions, have very differing average sizes Ozone (132 and 94 mkg/m3 accordingly) and maxima Ozone in October much more low, than in April. The most appreciable distinction, however, is repeatability of zero sizes. In October such 27 cases from 94, and in April – any took place. October is transitive month from summer by the winter [30, etc.] When summer processes are already weakened, and winter have not gained in strength. It causes a weak exchange on a vertical (in comparison with April) and fast decrease in ground ozone.

Apparently from the same table 31, extrema in all terms in July only in 2 times exceed average sizes. In April and in October during a day maximum they too only in 2 times exceed average value. In other terms, however, this excess can be in 5 and more times above, than averages for this term. For January, in view of a great number of zero values, conclusions are less reliable, extrema in a day maximum more than three times exceed an average, and in other terms they differ at 10-15 time. Marked features in sizes of averages and extrema allow to assume the following: there are any limiting sizes of concentration of ozone in atmosphere, whence it arrives in a ground layer. In the summer when the mechanism of a vertical exchange is most active, ground concentration of ozone is great, and they considerably come nearer to greatest possible taking into account possibilities of the mechanism of transfer. Therefore average and maximum sizes of ozone differ minimum in an annual course. During other seasons in the ground layer arrives on the average only a part of ozone from the possible.

Only at active synoptic processes of a condition of a vertical exchange temporarily improve (or not improve) there is a maximum (or a minimum), essentially distinguished from average.

Synoptic conditions at which extreme conditions of concentration of ozone take place, demand independent consideration, that by us is made below.

Some words about influence of the polluting substances (PS), contained in a ground layer, on concentration of ground ozone. As it is fairly marked in [30, etc.], such influence can be noticed in the winter, when natural ground concentration of ozone are small. However there are a lot of difficulties in the winter. In [30] it is underlined, that it is frequently easier to allocate horizontal carry of ground ozone, than influence of polluting substances.

In our case, however, in view of results of the analysis of the aerosynoptic conditions stated below, the certain conclusions to make it is possible. First of all, presence in a daily course of a minimum of ozone in 19 o'clock, i.e. in a rush hour, unequivocally specifies influence PS on destruction of ground ozone. Thus the important role in this process plays except for оксидов

nitrogen and окись carbon. It is known, that at emissions of modern thermal stations окись carbon is present only as traces. The basic contribution to ground concentration WITH brings motor transport. Calms and the weak winds prevailing here, promote that concentration ЗВ can collect up to significant concentration.

The secondary night maximum of concentration of ozone in 01 o'clock too has an explanation. At night when movement of transport strongly weakens, emissions carbon dioxide and nitrous oxides appreciablly decrease, process of destruction of ozone too stops. In city the air mass (unimportantly, from what side}) is displaced more richer by ozone. It also promotes formation of a night maximum. To the morning we have a natural reduction in concentration of ground ozone due to easing its receipt from above.

The local conditions promoting on the one hand accumulation PS up to high concentration, and with another - a plenty of automobiles and their emissions in city with the expressed daily course of activity is enough facilitate our analysis.

As a whole, however, the problem of ground ozone is still far from a desirable level of understanding and additional more detailed measurements and the analysis are required.

1.5. Long-term fluctuations of ozone.

Studying long-term fluctuations of ozone is of interest. If these fluctuations are somehow connected to changes of a climate and the general circulation of an atmosphere it will allow to consider such fluctuations of ozone as one of chains of the general circulation of an atmosphere. It was specified connection of acyclic fluctuations GMO with the general circulation still in [30]. There it has been shown, that a maximum of ozone by the similar image, appeared above the Western Europe and the Far East, has coincided with deep negative anomaly of temperature. Authors [43] came to a conclusion, that such anomalies are connected « not so much to separate intrusions of Arctic air, how many with the general gradual reorganization of circulation in Northern hemisphere ». Similar conclusions are made in [32] on supervision above Northern America where increase GMO on 7 % has been connected to a steady deepening in the winter of trough in the top troposphere above the east the USA which has caused carrying out of Arctic air, rich ozone, on the south.

Convincing enough results confirming the general reorganization of circulation are resulted in [30]. Authors have constructed twenty mons sliding average GMO for the period with 1961 on 1976 for stations Aroza and Tатeno in spite of the fact that points divide 130 degrees of a longitude, curve had the certain similarity. High maximum GMO in Apoзe took place in November, 1969, and in Tатeno - in February - March 1970y. Attraction of the data of station Arhus located on 10 degrees to the north of Aroza, has allowed to allocate a local component. Curves GMO for these stations were almost parallel, but in Arhus the maximum was higher and was observed later, than in Aroza. After 1969 of size GMO at both stations began to go down gradually. Occurrence satellite given, and also some other means now have allowed to study the given problem more deeply and more widly. So, in [44, 48] on the basis of the data of the National meteorological center of the USA are designed by two year long-term components of anomaly of the tropospheric and stratospheric moments of pulses for 1978-1992 г.г. It is shown, that distinctions of interannual variability of circulation of troposphere and a stratosphere can be explained by imposing two year and long-term fluctuations. On the basis of satellite measurements GMO it has been shown, that its interannual fluctuations above Antarctica in October can be explained a two year cycle of fluctuations of a zone wind of the bottom troposphere of equatorial latitudes (Singapore). In result have taken place long-term changes inter latitudes connections of circulation of a stratosphere. Hence, the initial reason of occurrence of an ozone gap above Antarctica is long-term easing of wave activity in average and high latitudes of a southern hemisphere. In the latest years a lot of works in which connection of fluctuations of the general circulation of an atmosphere with fluctuations GMO [30] is shown

has appeared. Thus, not denying an opportunity of chemical destruction of stratospheric ozone by HFC, it has been convincingly shown, that long-term changes of ozone are caused by the general gradual reorganization of the general circulation.

Let's look, as fluctuations of the general contents of ozone above Kazakhstan are connected to the general circulation of an atmosphere. As the parameters describing the general circulation, we shall take a long-term course of average annual temperature in Almaty (a product of the general circulation), Tokarev's and Bagrov indexes, and the ZONE index, taken in a ready kind from [16]. In figure 3 the century course of temperature on station Almaty and GMO for the same years is submitted.

It is possible to see, that practically to all extremely low mid-annual temperatures of air there correspond extremely high concentration GMO. Conformity to extremely high temperatures extremely low GMO, though and not so well defined takes place also.

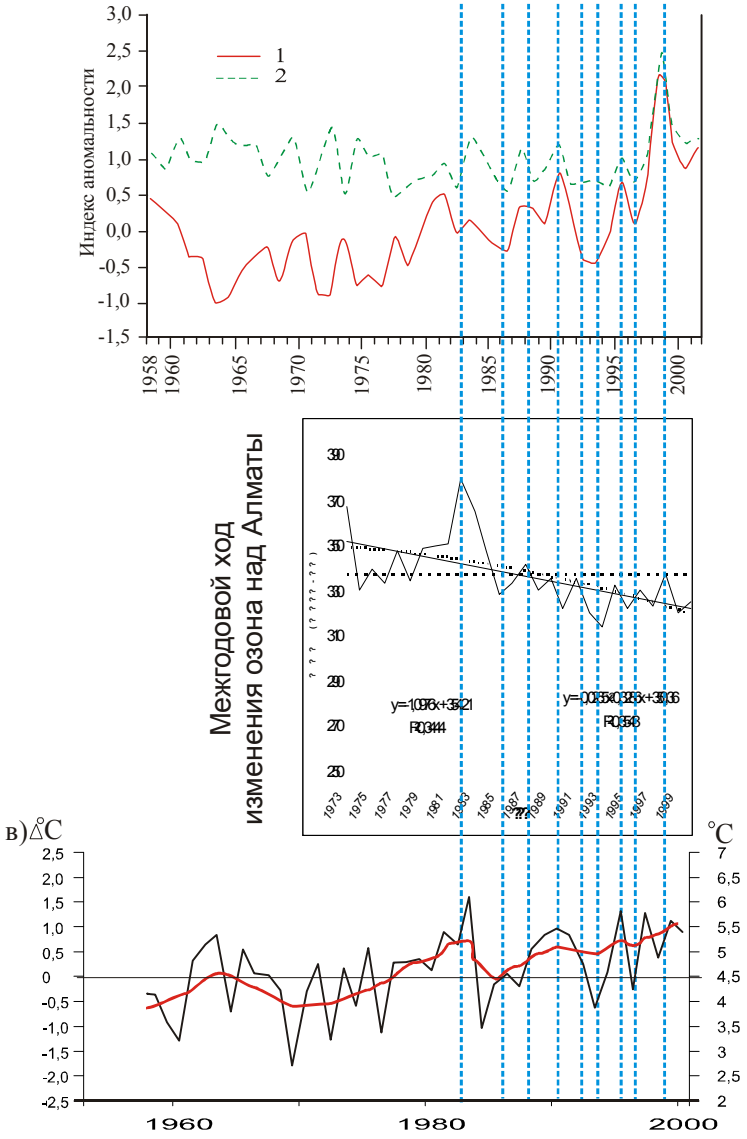

Fig. 3. Indexes of circulation of Tokarev and Bagrov indexes, and the ZONE index, and a time course of temperature and GMO on station Almaty.

As is known, [46, etc.] during the summer period interannual variability of temperature is insignificant. The basic changes occur in a cold season, so they determine size and a sign on annual anomaly. All cold intrusions are accompanied, as by us is shown above, the increased

concentration of ozone, is especial in a zone of fronts. It is caused by carrying out of air, rich ozone, from the Arctic latitudes. Arrival of tropical air to systems of subtropical crests is accompanied low GMO since this air is poor ozone. Hence, often and intensive intrusions of Arctic air form negative anomaly of temperature and positive - GMO. And often carrying out of air from subtropical latitudes - positive anomaly of temperature and negative - GMO.

On fig. 3 the joint course of Tokarev and Bagrov indexes and GMO on station Almaty for the same line of years is submitted. Earlier in [16] it has been shown, that a temporary line of average annual temperature for Kazakhstan well correlates with the above-named indexes. The temperature of air in Almaty is formed under influence of lines and other factors, except for analyzed. Nevertheless, we can see, that the basic extrema during the named indexes and in course GMO for Almaty coincide.

All marked above, specifies that the most significant fluctuations GMO are caused by fluctuations of parameters of the general circulation of an atmosphere. Hence, the forecast of changes GMO in Kazakhstan, including in long-term aspect should be based on the forecast of dynamicsof the general circulation of an atmosphere in Northern hemisphere.

1.6. Aerosynoptic conditions at which extreme concentration of ground ozone are formed

Represents practical interest research of conditions of formation, both the general contents of ozone, and ground one. Whereas conditions of formation of ground ozone in Almaty practically are not investigated, the greatest attention is given to this question.
Then conditions of formation of the general contents of ozone above Kazakhstan are considered. Last years it has been shown, that transboundery carry of ground ozone can have significant sizes. The special attention is given to this question too. We shall consider also the general tendencies of change GMO above Kazakhstan last ten years.

So, within day small strengthening of the crest focused to a southwest from the Siberian anticyclone on January, 17 took place. The maximum of its development took place, probably, about 21 o'clock. After that its easing and activization of cyclonic activity, including along foothills began. Within this day warm air in the bottom layer of troposphere acted in area Almaty from a southwest, impoverished by ozone. On separate sites of front, however, its essential displacement to a southwest under influence of a crest of an anticyclone (term 03 o'clock still took place.). In this situation the temperature of air in Almaty was lowered up to minimal (about- 9 C). Further carrying out of warm air has proceeded, and the temperature of air gradually grew. By the end of day on January, 19, in view of clearing in a afterboundary zone in the second part of day occured downturn of temperature and some growth of pressure that has led to appreciable downturn of temperature of air and strengthening of ground inversion.

Let's consider now a course of temperature and concentration of ground ozone at station Almaty, involving to the analysis also the data on concentration NO_x. On fig. 4 the temporary course of these parameters within three day on January, 17-19 is submitted. The maximum of concentration of ground ozone took place in all cases at presence of atmospheric front at foothills and displacement of a site of front to the north from foothills, i.e. at presence of a southern component of a wind in the bottom layers of an atmosphere (see maps). It occurs or in system of a wave on its warm site (on January, 17 and 18 if the front lays at foothills) or at active displacement of all site of front to the north on plain on southern Balhashregion (on January, 19). At such synoptic situation there is also a receipt of tropospheric ozone to the ground from its maximum located at some height in a tropospheric layer [8, etc.] . It proves to be true also climatic generalizations of ground ozone. Its maximum in a cold part of year takes place in the morning when the mountain component mountain - valley the circulation reaches a maximum, delivering to the ground enriched with ozone air.

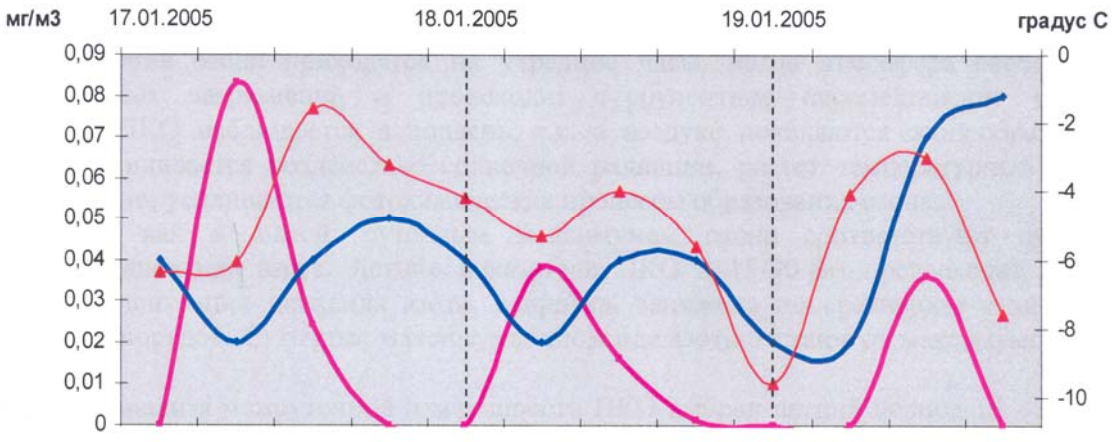

Fig. 4. A daily course ground concentration nitrogen oxides and temperature for the period on January, 17 and on January, 19, 2005.

Only in the summer, more precisely, in a warm part of year when thermal convection is very strong, time of receipt of a maximum of ground ozone is displaced on 13-15 o'clock of local time. On fig. 13 the temporary course of concentration of dioxide of nitrogen is resulted also. It is possible to see, that it has the expressed daily course with a maximum in a second half of day, about 13 o'clock and, a minimum in the morning, about 7 o'clock mornings. As is known, the layer, rich ozone, at heights of 500-1000 m during the summer period is absent [8]. Therefore in time 07 o'clock, despite of presence of a mountain wind of increase in concentration of ground ozone it is not observed. The maximum of dioxide of nitrogen and carbon dioxides about 19 o'clock is caused by emissions of motor transport which activity at this time is maximal. After that its concentration gradually goes down, including and due to a mountain component of a wind, the maximum which takes place to the morning. The role of this component and others PS, apparently by the example of dioxide of nitrogen, for Almaty is of great importance. (a Fig. 5).

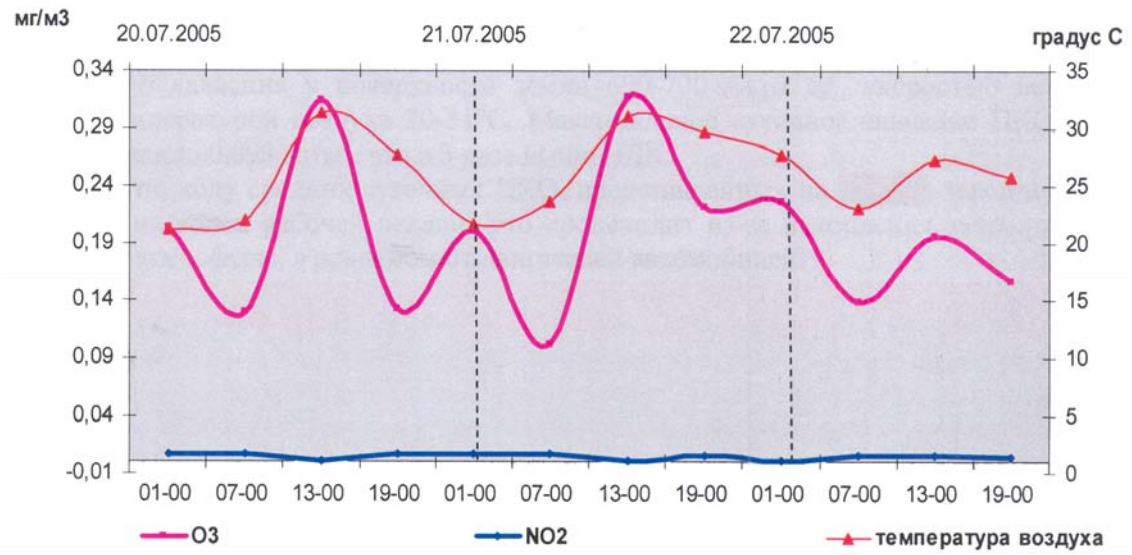

Fig.5. A daily course of ground concentration of nitrogen and temperatures from July, 20 till July, 22, 2005.

As if to concentration nitrogen dioxides and carbon dioxides in points of a maximum they depend also on intensity of ground inversions. When they are more strongly expressed, the concentration NO_x is higher. It is necessary to remember, however, that fluctuations NO_x due to

intensity of movement of transport occur on a background of concentration NO_x caused by emissions of the power enterprises. These emissions have no daily course, and the ground concentration, caused by these emissions, change within day depending on conditions of dispersion.

Thus, influence of concentration NO_x despite of their significant sizes during winter time, for ground concentration of ozone us are not found out. Probably, such influence is while within the limits of errors of measurements.

In the summer in a daily course of concentration of ground ozone the expressed basic maximum at 13-15 o'clock, and a minimum in 07 o'clock mornings takes place. As it is marked by us above, the maximum is caused active thermal конвекцией, providing receipt of ozone from troposphere.

The maximum of ground ozone in its time course takes place then when the general maintenance of ozone (GMO) and tropospheric ozone increases also, i.e. in a zone of atmospheric fronts in a southeast part of tropospheric hollows. It corresponds to a site of cold front at the ground, at once behind front. Such situation is considered by us in 1.7.2.

1.7 Dynamics and internal structure of monthly sizes of the general maintenance of ozone above Kazakhstan.

Dynamics of atmospheric ozone above Kazakhstan after the fiftieth years of the last century practically was not studied. However is proved heightened interest to a problem on the part of the world community and of some the International Conventions which Kazakhstan has joined, have made such researches necessary [6, 8].

Dynamics of the general maintenance of ozone (GMO) above Kazakhstan was studied by us for the period with 1998 on 2006 Distribution GMO above Kazakhstan is a result of large-scale general circulation of an atmosphere above a significant part of Northern hemisphere. Therefore the information about GMO on space from Atlantic up to Silent oceans was used. sach data are on a regular basis published in reviews in magazine « Meteorology and the Hydrology », and also contains in works [3, 4, 5], etc.

1.7.2. Synoptic conditions of formation of extreme sizes GMO

Further we had been selected cases of extreme sizes GMO above Kazakhstan. Thus for a case took a situation when even on one of stations of Kazakhstan GMO deviates in any side norm up to 2,5 or more values of an average quadratic deviation{rejection} (□) [11, 12].

For an example we shall consider aerosynoptic conditions when extreme values GMO took place.

Thus, extremely high concentration of ozone were observed in system of especially deep trough, on its southeast periphery as a result of intrusion of a cold Arctic air, rich by ozone.

Deficiency GMO which has made 2,7 □, and the next day and more, took place in system of the crest generated as a result of intensive of longitude carrying out of tropical air through the western areas of Kazakhstan. In the top troposphere on 300 hPa the independent area of a high pressure specifying simultaneously and on intensity of carrying out of heat and was generated that displacement of system will be slow. Actually and was. With breaks, as a result of a pulsation of parameters of aerosynoptic system, deficiency GMO took place within several day both above Karaganda, and above Semipalatinsk. Above Almaty, however, deficiency GMO was not observed, as receipt of cold air on east periphery of system here took place.

The deep analysis of all cases abnormal GMO which we have collected, presumes to find quantitative characteristics between GMO above Kazakhstan and parameters of circulation on the basis of which development of recommendations to the forecast extreme GMO is possible.

1.8. Tendencies of change GMO above Kazakhstan

The contents of ozone in an atmosphere is determined mainly by the general circulation of an atmosphere. Infringements of activity of the mechanism of the general circulation can lead to change GMO above huge territories. So, for example in [14, etc.] it is shown, that the initial reason of occurrence of an ozone gap above Antarctica is long-term easing of wave activity in average and low latitudes of our hemisphere. The similar approach is necessary and at the analysis of features of distribution of ozone above Northern hemisphere and Kazakhstan in particular.

The analysis of time course GMO on stations of Kazakhstan shows, that since 1984 has gradual reduction of deficiency of ozone (fig. 6). The executed comparison of distribution GMO above Kazakhstan and above all Eurasia is shown, that all changes are interconnected (fig. 6).

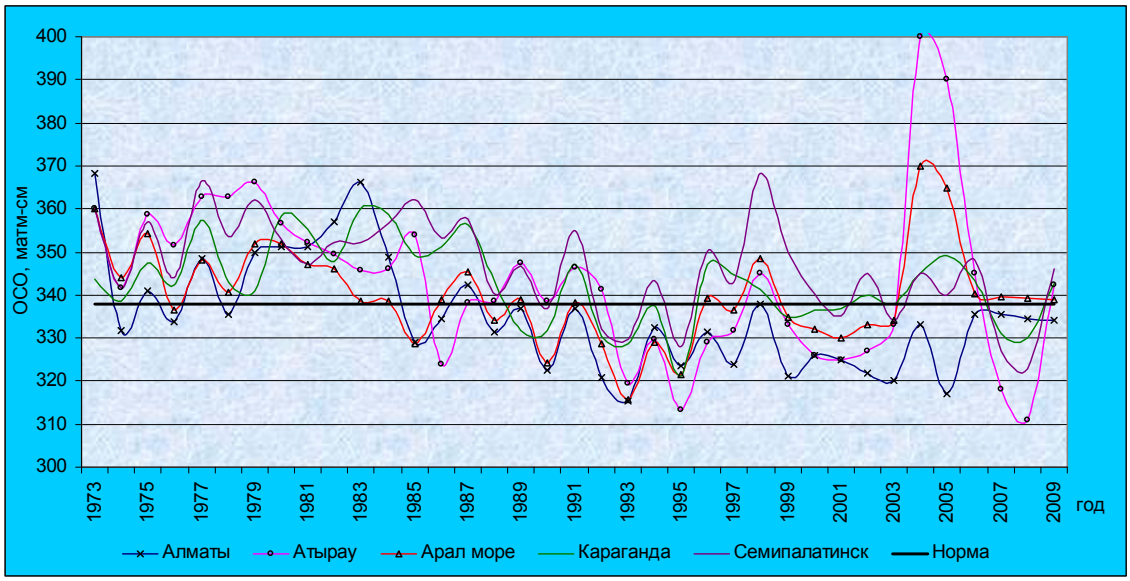

Fig. 6. A time course of the contents of ozone above Kazakhstan.

So, as a whole for 2008 above Eastern Siberia and Chukotka GMO norms are higher 5-6 %. Above Kazakhstan and the European part of Russia it is lower than norm on the average for a year not the same of 5-7 %, above the Western Europe deficiency GMO makes 0-4 %. In separate months, however above Kazakhstan and other regions, GMO it happens above norms (fig. 7). Within 2009 GMO has increased above all Northern hemisphere approximately for 1-2 %. It is necessary to note however thus, that because of inconstancy of circulating conditions interannual fluctuations of ozone which complicate allocation of its time trend take place also.

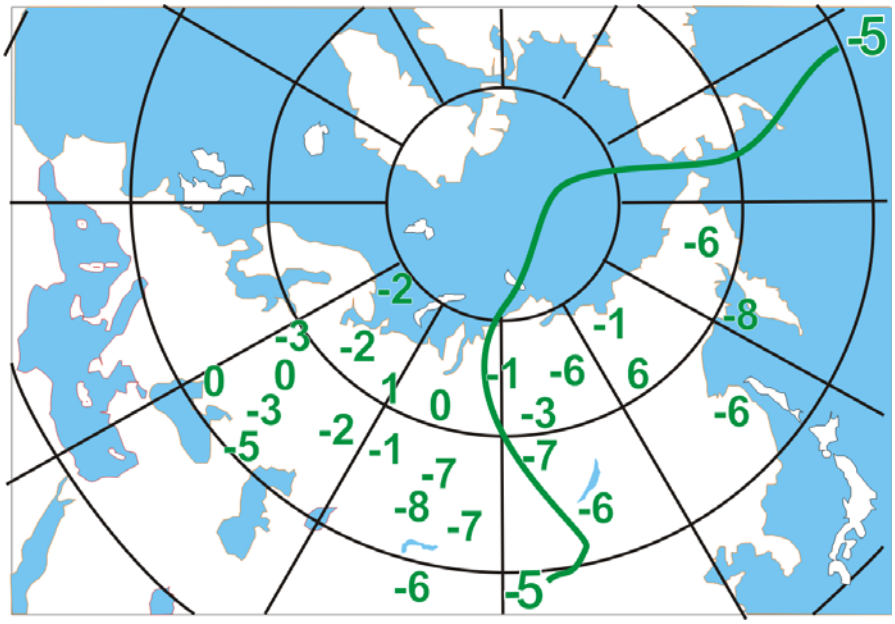

Fig. 7. A deviation of average annual sizes GMO from norm on territory of Kazakhstan and in adjacent territories for all 2005.

To allocate a share of increase GMO due to reduction of emissions ozone depletion substances very difficultly, especially a share of increase GMO above Kazakhstan. On an ozone cloud above Northern hemisphere some researchers estimate total positive influence in 1 % one year. [12, 61]. This trend, however in due course should decrease a little. As a result of alignment GMO with norm in Northern hemisphere it is expected through 7 - 9 years, this forecast can be counted comprehensible and for Kazakhstan.

1.9. Hemisphere models for trans boundary carry of polluting substances, some results for Kazakhstan on ground ozone.

In the given section the basic characteristics of two hemispheric models for calculation of polluting substances above Northern hemisphere and results of modelling for Kazakhstan are considered.

Studying trans boundary carry PS is the important problem in questions of change of a climate and for its decision is worked hard. One of perspective directions of the decision of a problem is mathematical modelling processes of carry, creation regional and hemisphere models of carry and sedimentation ЗВ. The regional models created, for example, for territories of the Western Europe or the USA represent the insignificant information on distribution PS on territory RK. From 26 models which we have considered for comparison of their efficiency/17/, we have chosen only two: hemisphere model EMEP and model CTM2 of faculty of geophysics of university in Oslo (18). The given choice is caused by that these two models well enough describe carry ЗВ and chemical transformations of ground ozone.

Thus by Hydrometeorological service of Kazakhstan from all PS distant carry it is measured only приземный ozone. It allows to estimate an overall performance of models for territory РК even in general.

Results of modelling on models EMEP and CTM2 have passed good and long verification [18]. We shall be limited to results of modelling of ground ozone and accompanying PS and their adaptation for territory of Kazakhstan.

On rice 8 distribution of ground ozone above Kazakhstan in January on models CTM2 and EMEP accordingly is submitted.

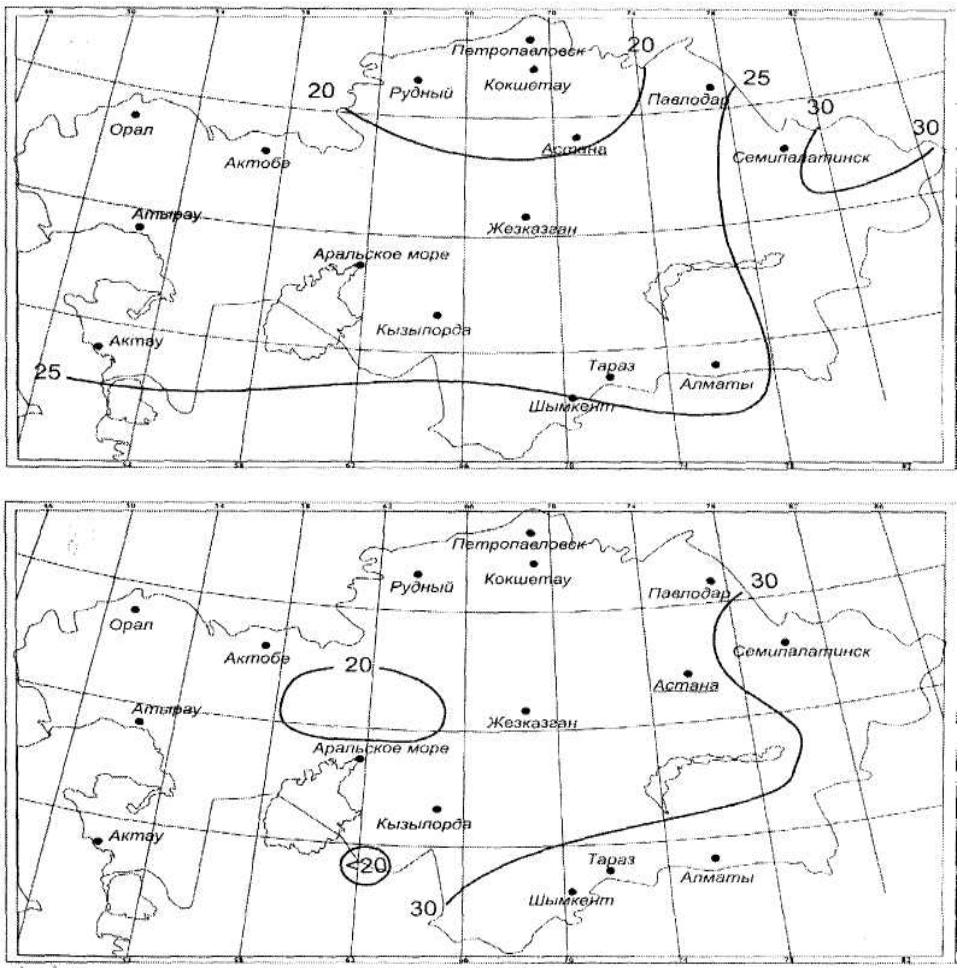

Fig. 8 Distribution of concentration of ground ozone (ppв) above Kazakhstan in January on models CTM2 and EMEP {8},

Model EMEP gives size of ground ozone 20+25 ppв above the central areas of Kazakhstan about a minimum 20 ppв and less above northwest and Kazakhstan to the north Aral see. To the southeast it concentration of ozone grow, exceeding 30 ppв in the east and in a southeast of territory, i.e. in areas of Semipalatinsk - Almaty.

Model CTM2 (fig. 8) an axis of a trough with the minimal sizes of ozone has longitude ways above Northern Kazakhstan and only to the south 50 ° n.l. It turns to a southeast. Accordingly, the lowest concentration of ozone take place above Northern Kazakhstan, 20 ppв and less, and the highest, 30 ppв, as above the east and a southeast of territory.

Comparing results of modelling with the data of supervision over ground ozone in Almaty, we mark, that the concentration received on model CTM2 are closer to observable. Presence of the hills interfering free carry of air weights from the south, rich ozone is possible, provides conditions when the air weights acting from northern component and poor ozone prevail of the south and a southeast of Republic. At the same time the course of ground ozone lines above territory of the Republic, received on both models, is very close. Results of modelling for July are submitted on fig. 9

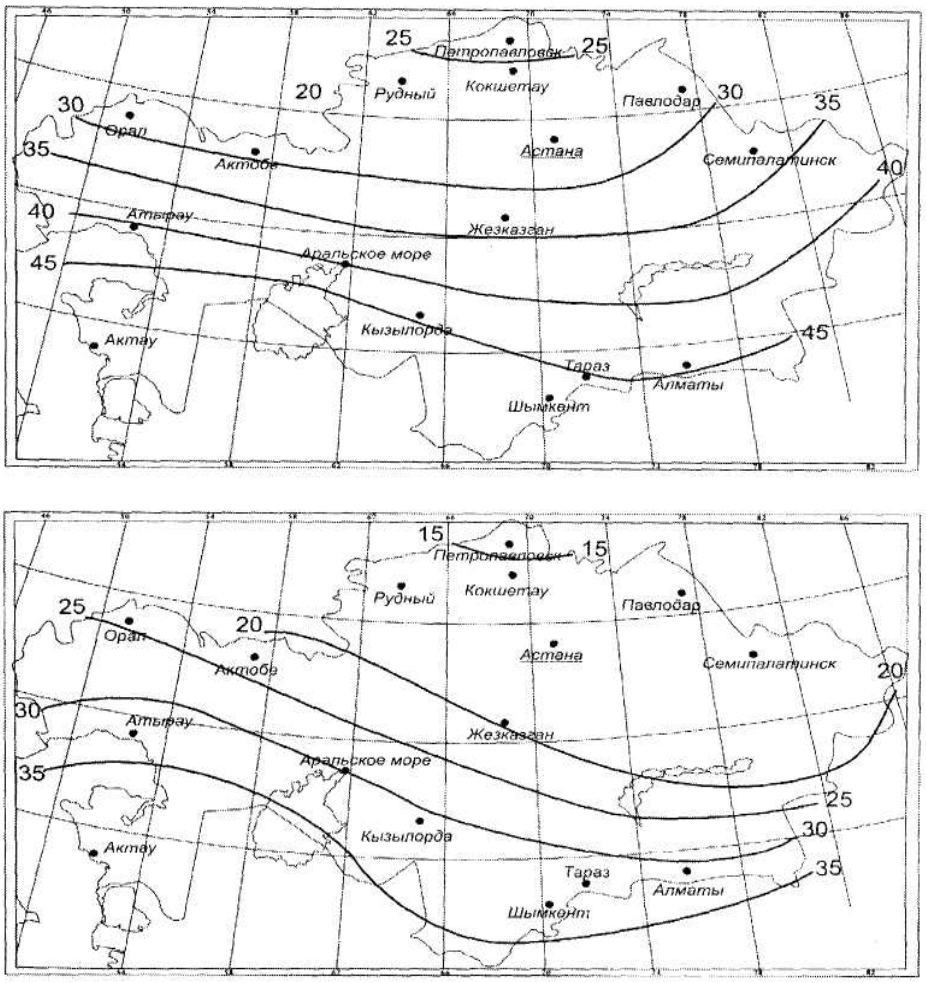

Fig. 9 Distribution of concentration of ground ozone (ppв) above Kazakhstan in July on models CTM2/a/ and EMEP/б/

Both models give a trough focused from northwest on a southeast. Both models give a range of change of ozone within the limits of territory of Kazakhstan from the south on the north in 20 ppв. However model CTM2 - in a range 45-25 ppв., and EMEP - 35-15 ppв. Comparison of results of modelling with the data behind ground ozone in Almaty allows to draw conclusions, that model EMEP underestimates, and model CTM2 overestimates concentration of ground ozone on 5-6 ppв. Besides model CTM2 gives rather smooth reduction of concentration with increase in breadth. Only to the north 50 ° n.l. Gradients appreciablly decrease. Model EMEP the basic reduction of concentration of ozone gives in a strip to the south of a line of Balkhash - Aktyubinsk. Absence of supervision over ground ozone still somewhere, for example, in Northern Kazakhstan, does not allow to draw with full confidence conclusions for the benefit of one of models. The knowledge, however, a mode of direct solar radiation and summer temperatures of air in Kazakhstan, allows to assume, that model CMT2 displays a course and the general distribution of ground ozone it is better.

One of the main for mankind of problems is reduction in emissions in atmosphere PS of all kinds. In ESC-W conditions as concentration PS changes, have been simulated by trans boundary carry if emissions PS to reduce by 15 % on the basic regions of Northern hemisphere. Not having an opportunity to stop on the simulated results for all PS, we shall stop only on what initiate both formation and destruction of ozone.

In table 4 expected changes of concentration of ground ozone above Kazakhstan if emissions NO_x and PM in corresponding areas will decrease for 15 % are submitted. It is possible to see, that against expectation the greatest influence on Kazakhstan is rendered with

emissions PS by the industry of the countries of the Near East. Reduction in emissions PS there on 15 % results in reduction in average annual concentration of ground ozone on 0,15 ppв. Thus both models give approximately identical size.

Middle East, i.e. Iran, Iraq, Turkey and the Mediterranean, give in Kazakhstan an average annual background of ground ozone approximately in 0,1 ppв. Such significant size in comparison with industrially advanced regions is caused by that the most part of year carrying out of air massis occurs from Middle East.

Table 4 Average annual sizes of reduction in concentration of ozone (ppв) in territory of Kazakhstan for the account trans boundary carry at reduction in emissions on 15 % in regions - donors accompanying 3B.

Regions	3B	Sizes of reduction
The Far East Middle East Northern America Europe	NOX + PM	- About 0,15 ppв on all territory Kazakhstan - Less than 0,1 ppв to the south оз. Balkhash and about 0,0-to the north - About 0,10 ppв on all territory on The extreme south - has less A southwest of Kazakhstan down to оз. Balkhash about0,10 ppв. On other Territories about0,05 ppв.
The sum		0,45 ppв

Average annual concentration of ozone in territory of Kazakhstan 0,25-0,30 ppв air massis occurs from Middle East. Regions of Europe and Northern America provide on 0,1 ppв ozone. In the sum for the account of trans boundary carry we have concentration of the ozone equal 0,45 ppв in Kazakhstan. How the background if receipt atmospheric 3B to Kazakhstan would stop at all will change? Then concentration of ground ozone would decrease on 3,5 ppв, that makes about 10-15 % for the south of Republic and 15-20 % - for itsnorthern areas.

The executed analysis shows on international character and the pollution of an atmosphere and struggle against it.

2. THE ESTIMATION OF CONSUMPTION OPB IN KAZAKHSTAN ON SECTORS OF ECONOMY IN 2009 AND THE SCRIPT THE NEAREST YEARS

2.1 Dynamics of quantity consumed ozone depletion in Kazakhstan

Usually any national strategy bases on the current data. It is necessary and an important point which allows to establish « width of a corridor » in which there can be changes. As a rule, the a line is longer, the estimation of forecasting will be more exact. In our disposal there are data for last fifteen years. However, unfortunately, to speak about uniformity of lines, it is not necessary stability of external factors. During monitoring behind consumption level OPB in Kazakhstan there were essential changes, both in quantity consumed HCFC, and in their quality indicators. The structure of consumed substances has changed, there is a reorganization of the market of the equipment where the mentioned substances are used. Certainly, such cardinal measures should affect a consumption level. Besides it is impossible to forget, that from the moment of occurrence of the Viennese convention has passed not less than 30 years and for this time innovative decisions in the equipment have been realized many. In view of that average term of operation of household refrigerators makes 25-30 years, commercial 12-15 years, and complex systems of cooling of stadiums, skating rolls, warehouse or technological premises can

make more than 30 years during existence of the Convention it was replaced already and park of the equipment.

Certainly, such conditions do not allow to speak unequivocally about stable consumption as the equipment and substances involved in contours. It is not necessary to forget and that realization of scientific decisions, as a rule, is directed on reduction of consumption of capacity that is realized through reduction of volume of HCFC its change and technical characteristics. Accordingly, realization of technical decisions at constant number of park of the equipment will already promote reduction of consumption ODS.

It is not necessary to forget and that new substances have appeared, which to attribute to action of the Montreal report hardly, they already get under action of the Киото report. It, certainly a favorite of the modern period - хладон 134a, however except for it are available set of mixes both азеотропных and зеотропных which are successfully applied in contours as in new refrigerating systems and are capable to work in the out-of-date equipment prolonging time of its operation. Unfortunately, inside the country the control over a consumption level of such mixes is not conducted almost, therefore at an estimation of demand on ODS the real parameter can be not always objective as the valid consumption is blocked just by such substances. Accordingly, at an estimation of demand in model it is possible to assume only about real volume of consumption, proceeding from the period when such substances in the country yet were not, and the amount of the population was equaled modern.

2.1.1 Consumption level ODS in 2009

In 2009 in Kazakhstan it has been consumed in the sum of 1067,5 tons ODS. It not much is more than the last year, however if to consider the given figure separately on substances it is possible to find out, that the basic in клад in the general consumption occurs basically because of transitive substance HCFC 22. For today the level of its consumption is 908 tons that makes 78 % from general consumption level ODS. In figure 10 dynamics of consumption ODS in Kazakhstan for last 12 years is submitted.

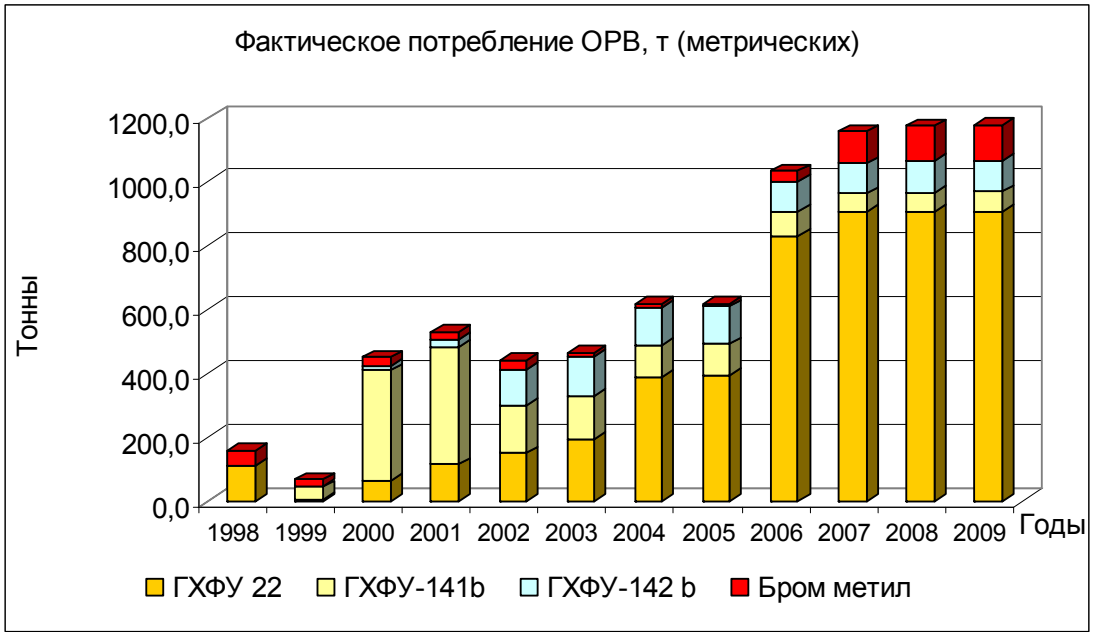

Fig. 10. Dynamics of consumption ODS in Kazakhstan for last 12 years.

However, by developed tradition as the consumption level in tons is not indicative for an estimation of influence on an ozone cloud, it is necessary to present metric tons to tons ozone depletion to ability (ODS). As a rule, traditionally used substances can possess very much

different effort on influence on an ozone cloud, for this reason usual metric tons are not indicative, as different substances at identical volumes possess different destroying abilities.
HCFC represent chemical substances in which one or more atoms of carbon are connected from one or more atoms of halogens (fluorine, chlorine, bromine or iodine). Ozone depletion ability HCFC , containing bromine, as a rule, much above, than at what contain chlorine. Synthetic chemical substances which provide the most part of chlorine and bromine for destruction of ozone, are bromic methyl, Metilchloroform, Tetrahclormetan and family of the chemical substances known as HCFC and an.

To each adjustable substance the factor describing its influence on a stratospheric ozone cloud on a mass unit of gas in comparison with the same weight CFC-11 is appropriated . These factors ODS for each adjustable substance are specified in appendices to the Montreal report []. According to the Management on granting the data within the framework of the Montreal Report factor ODS for bromic methyl 0,6, and for HCFC 22 - 0,055. In this case the real picture will look a little differently, fige 11.

It is possible to see, that the consumption level in tons ODS essentially changes a picture. So the basic substance which renders negative influence on an ozone cloud is bromic methyl though its real consumption is lower almost in 7 times in tons metric.

The second on a level of influence is HCFC- 22, this transitive substance which can be used within the framework of the Montreal report. Except for that this substance is the potential applicant for an interdiction in use and most likely it will be applied only together with other substances - in mixes.

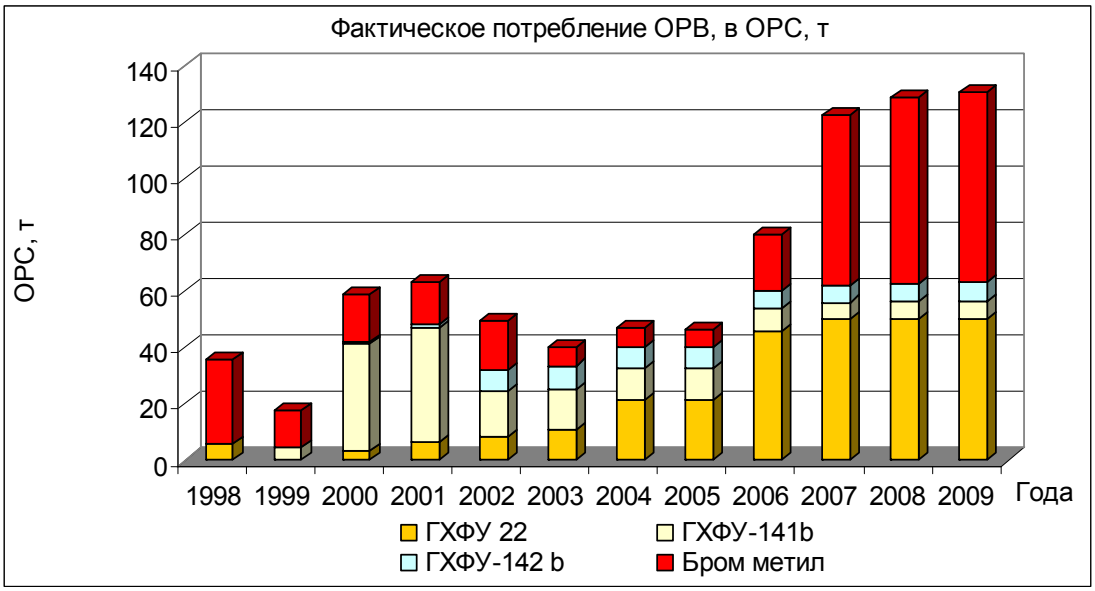

Fig. 11. Dynamics of consumption ODS in tons ODP Kazakhstan for last 12 years.

It is possible to see, that consumption of agents has appreciablly increased last four years. At the present stage the amount used ODS almost three times exceeds a level 2003-2004 гг, and five times a level of 1999.

Besides from the submitted data it is visible, that such appreciable difference was formed basically due to increase in consumption of bromic methyl, with its high enough factor ODS. The amount of used bromic methyl is comparable to the sum of all other substances of all categorys (fig. 12).

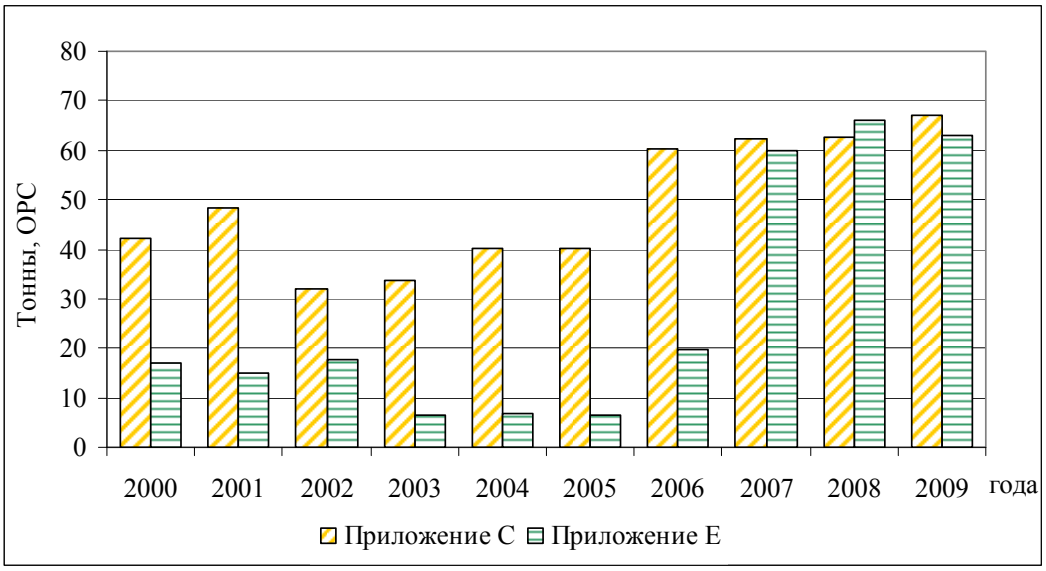

Fig. 12. A comparative consumption level of bromic methyl (Appendix E) and transitive substances (Appendix C) for 10 years, in territory of Kazakhstan.

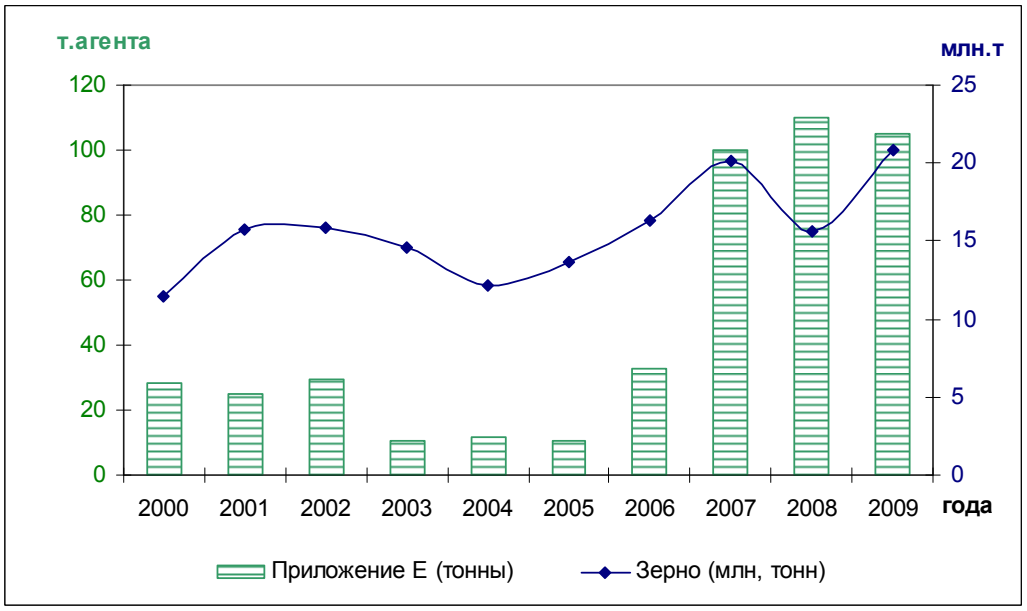

Fig. 13 comparative consumption level of bromic methyl (Appendix E) and manufactures grain in Kazakhstan.

From the submitted figure 13 it is visible, that the Increase in consumption of bromic methyl is connected to increase in manufacture and import of grain crops. According to world situations the grain cannot be sold if preliminary it has not been processed in the quarantine purposes. On the other hand as bromic methyl is the substance destroying an ozone cloud its application try to limit, on what the Copenhagen amendment is directed. And, right the question with the status of this substance is in study to performance, and there is a probability, that farms and firms on export have some stock of bromic methyl in the banks to avoid its deficiency in the future as in the country in connection with licensing of the substances getting under the Montreal report, process of purchase of the agent was essentially complicated. Besides there is a probability, that sale of bromic methyl to Kazakhstan will be limited for the lack of ratification of the mentioned amendment.

At the same time from figures 1 and 2 it is possible to see, that consumption of such substances as HCFC 141b and HCFC 142b is at a stable level and varies year by year insignificantly. And appreciable dynamics of growth of demand not these agents it is not observed, that speaks about a constant niche in the market where the mentioned agents are used.

Figure 13 evidently shows, as the situation for last ten years in market ODS varied. Besides figure shows, that has changed from the moment of refusal from ODS Appendix A and In in 2004. It is possible to see, that a role of transitive substances, since 2000 began to grow. However, even after full refusal of application of the mentioned substances of sharp demand for substances of the appendix C does not occur. It can be connected to set of the reasons, first of all with problems of technical character. Today, unfortunately, there is no such substance which could replace completely in all sectors, freons 11 and 12.

First, not knowing technical characteristics of the new substances, many firms were not defined finally with a choice [6-8, 10-13, 24, 25].

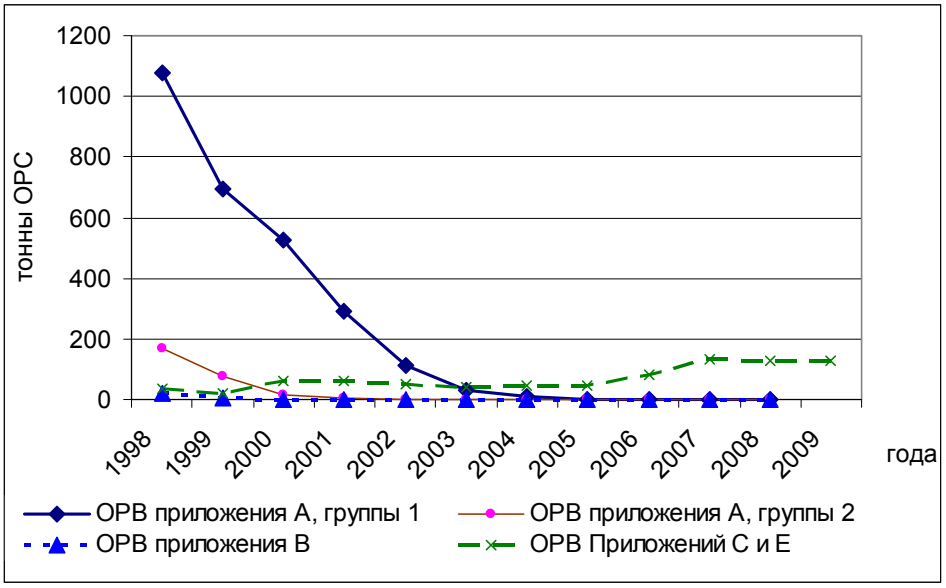

Figure 14 - Volume of consumption ozone depletion substances in Kazakhstan for 1998-2009.

Second, during economic reforms in the ninetieth years, many businessmen bought new technical equipment which has been already initially charged by transitive substances, and besides corresponded{met} to the international requirements of manufacturing of that moment. It turns out, that demand has not increased yet because of rather new equipment which is maintained in commercial sector.

The third reason of such position, can be presence in the market and sphere of services of illegal freon which does not get under the control of official statistics, but, nevertheless is present. It still proves to be true also that fact, that after 2004 when Kazakhstan has completely refused to operait of the CFC substances, demand for transitive substances in all sectors, has increased insignificantly.

The fourth reason of such situation can be, the incorrect statistical data for the period of 1998 with which values we carry out comparisons. There is a probability, that these data for any reason have been strongly overestimated, or the methodological mistake in calculations is accomplished. The probability of it is improbable, however completely to exclude it does not follow.

As the fifth reason it is possible to assume, that after introduction of some programs in territory of republic, explanatory work which was conducted among suppliers of the equipment and technicians, the role of the fulfilled freon has increased. It is possible, that the enterprises

intentionally buy up an old refrigerating machinery from which it is possible to take not only copper as nonferrous metal, but also the stayed freon. In fact after clearing of oils and other impurity, probably, it ODS refuse. Unfortunately, we do not possess for today real conditions in the market freons, but if it so we can see action of the State programs in a life.

The consumption level in 1100 tons ODS, grows out uses CFC 11 and CFC 12, factor ODP at which highest. Besides in a reality in metric tons this figure is a little bit lower, nevertheless it reflects potential top volume of substances which is necessary for Republic. In connection with replaceable systems of economic activities it is possible to assume, that from the submitted figure it is possible to take away half, having written off it on railcars - refrigerators which operation for today have refused. One more share can be written off on reduction of supersize automobiles with refrigerators which were used at transportations.

Thus, the top level of real consumption makes about 1500 tons хладона in one year. It is possible to expect, that the top border can change aside increases at successful development of economy and realization of all planned State Programs.

For us important to consider as these substances are distributed{allocated} on categories of refrigerating sector to find out what of sectors uses HCFC more and it is accordingly potentially vulnerable at refusal of transitive substances or use of substitutes.

2.1.2 Consumption ODS on categories.

In figure 14 distribution of consumption ODS on sectors is submitted. It is possible to see, that the ratio of consumption varies year by year insignificantly, however in the sum amount of the consumed substances can vary appreciablly besides that demand in the last some years has a little increased. It is possible to explain it to that in the country already there is enough of the equipment working on transitive substances. As the percent of such equipment year from one year will grow, it is possible to expect increase in demand and at coolants of the appendix C.

Figure 14 - Distribution of consumption ODS of the Appendix C on sectors in Kazakhstan.

Distribution inside sectors can change essentially. Today, getting household refrigerators, the buyer what coolant a little worries, it uses in the work. The consumer the consumption level of energy, guarantee period and operational qualities first of all can interest. Therefore transitive substances here can be quite used, that actually and occurs.

In other sectors where the equipment is in itself estimated highly, there is a high probability, that buyers already now began to pay attention what coolant is used. In fact not far off prospect of full refusal of use of transitive substances. To appear in a situation when the equipment is, and to fill it there will be nothing, nobody would like. Certainly, there is a variant of a choice of other substances which will meet not absolutely to all operational requirements that will cause losses of efficiency, and, hence, financial losses [6-8, 11-13, 38].

2.1.3. Influence on climate ODS

Calculations are executed on the basis of the data contained in the report on the first stage of researches. Thus as it is accepted in world{global} practice, that banks annually lose 5 %, HCFC contained in them. Transitions coefficients are taken in accordens with recommendations of IG on CC UNEP. [20] and [34]. Estimations of emissions CO2-ecv. are executed on groups галоидоуглеводородов, and then shown together (Figure 15).

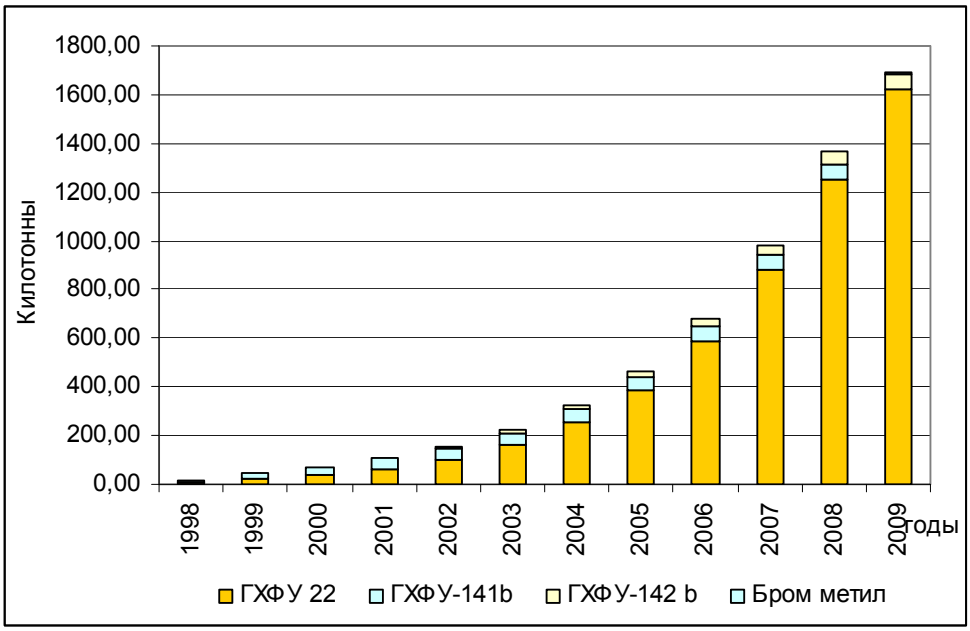

Fig. 15 - Total emissions CO2-экв., for the period 2000-2009 гг

Consumption HCFC such as 141b is carried out in small amounts. Sizes of consumption make approximately 5 % in comparison with HCFC such as -22. Emissions CO2-ecv., however, make only 3-4 % in comparison with HCFC -22, that is caused by a parity between factors ПГП 5:2 for these groups. A maximum of consumption HCFC -141b then its consumption began to fall sharply.

HCFC such as -142b are used in the same quantity{amount}, as -141b. Emissions CO2-ecv., however, exceed similar from -141b in eight times. It is caused by that ODP for -142b three times is more, than for -141b.

It is possible to expect, that by 2015 emissions CO2-tcv.. on substances -141b and 142b will be small as consumption of these substances tends to reduction.

As against calculations on other substances in this case was accepted, that all got bromic methyl was used within one year. Consumption of bromic methyl has appreciablly increased last years, approximately in 4 times in comparison with 2000. At the same time emissions CO2-ecv. (greenhouse effect) from group E are insignificant, since. ODP for this substance makes only 5.

Total emissions CO2-ecv.. from all groups HCFC for the period with 1998 on 2008 are resulted in the table 5. These emissions from a minimum in 2000 (10-20 Кт) have increased by

2009 up to 1650 Кт. Thus the basic contribution is brought with emissions from -22. Emissions CO2-ecv. from group E on a background of emissions from substances of group C as a whole practically are not significant.

2.2. Consumption of substances of group HFU on sectors

For last ten years the market of substances which are used in a refrigerating machinery, has essentially changed. To this promoted ratification of the Montreal Report by a plenty of the countries (for today more than 180). As it was already spoken the Montreal Report forbids use of substances of Appendix A and In where concern фреоны 11 and 12, and also limits use of transitive substances of the Appendix With and E.Ponjatno, that in the world there is a necessity of development and use of new substances which safety requirements would answer all modern and satisfied to technical needs.

We shall not stop on technical complexities of a task in view, we shall note only, that the decision of the given problem is a task of a world scale and today not one scientific division works in the given direction. Unfortunately, to receive ideal HCFC, which met all requirements of the market (as it was in a case with R-11 and R-12) it does not turn out yet. Developers have gone in other way creation for each sector of the substance which met local requirements. Such approach yields the certain results, and the whole spectrum of substances which are aimed at application in the certain type of the equipment for today is offered.

The developed substances of category HFC have been offered as long-term replacement and both in systems of cooling, and in devices of an air conditioning that became the conventional approach within the framework of the European community.

HCFC differ good thermodynamic properties. It means, that they completely satisfy to specifications and requirements to effectevenes for developed systems, and also for modernized systems in which coolant R502 was earlier used. These systems can be various - from small independent refrigerating machineries up to the equipment for supermarkets and the industrial process equipment. ГФУ - the best, for today, a coolant for the new systems replacing in what it was used R22.

Within the framework of performance of our task it was required to estimate quantity used HFC, as one of the most perspective substitutes ODS in the market, including substances of the Appendix C. The data of Customs committee available in our disposal, questioning of firms on service of a refrigerating machinery allow us to estimate amount in the market of this agent in 30 % from the general consumption of substances of the Appendix of C. The some we have in the given segment of the market is appreciated within the framework of National Inventory of green house gases of republic Kazakhstan, (fig. 15 and table 5).

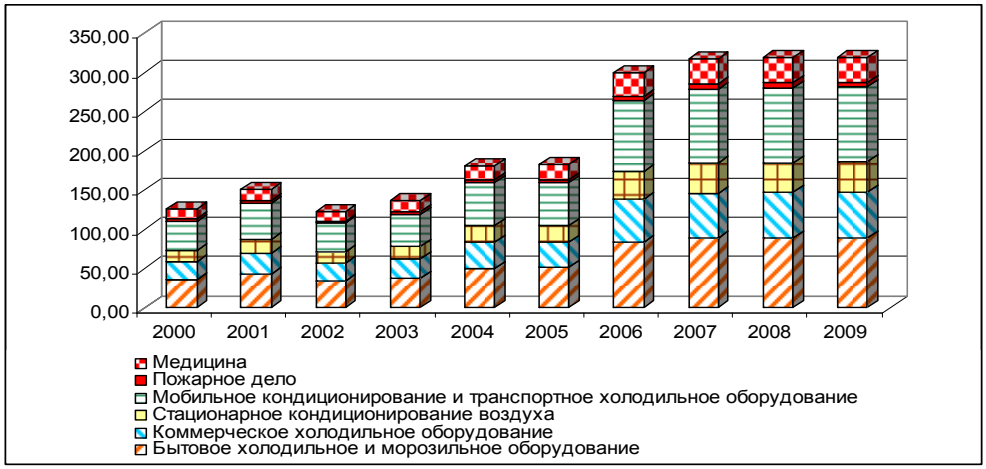

Figure 15 - Distribution of consumption HFC on sectors in Kazakhstan.

Table 5

Distribution of consumption HFC on sectors in Kazakhstan

Years	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
The household refrigerating and freezing equipment	35,37	42,46	34,44	38,09	50,79	51,08	84,02	88,81	89,45	89,67
Commercial refrigerating machinery	22,74	27,29	22,14	24,49	32,65	32,84	54,01	57,09	57,50	57,64
Stationary air conditioning	15,16	18,20	14,76	16,33	21,77	21,89	36,01	38,06	38,33	38,43
Mobile air-conditioning and transport refrigerating machinery	37,90	45,49	36,90	40,81	54,41	54,73	90,02	95,15	95,83	96,07
Fire business	2,53	3,03	2,46	2,72	3,63	3,65	6,00	6,34	6,39	6,40
Medicine	12,63	15,16	12,30	13,60	18,14	18,24	30,01	31,72	31,94	32,02
In total	126,33	151,63	123,00	136,04	181,38	182,44	300,06	317,16	319,45	320,24

To given

Sector 1 « the Household refrigerating and freezing equipment »

Apparently from table 1, consumption of substances of group HFC has increased, however on weight this group does not compensate group ODS which were used earlier. It is caused by that together with change of chemical substance more economical has appeared also new, with smaller volume of "banks {technical equipment}.

Sector 2 « the Commercial refrigerating machinery »

Use of substances of group HFC began since 2000. Consumption of substances of this group in it approximately twice is more than in sector 1, it is connected, partly with often перевозом the equipment рои which there are outflow.

Sector 3 « the Stationary air conditioning »

In this sector use of ammonia takes place instead of and other substances which do not get under Киотский the report for this reason expected quantity of HFC a little bit less than it was expected.

Sector 4 « Mobile air-conditioning and a transport refrigerating machinery »

From table 7 it is visible, that appreciable growth of consumption of substances of group GFU began since 2004. It is caused by heavy export of automobiles those years in which conditioners filled 134 have been established and.

Sector 5 « Fire business »

The last years for this purpose substances of group ODS were used. However according to the answer of the Ministry of Emergency Measures to our inquiry last decade getting under the account Montreal or Киотского the report in banks at fire brigades is not present substance. Nevertheless in this sector we have estimated use ГФУ in 2 % from general consumption level HFC.

3. THE ANALYSIS OF MEASURES UNDERTAKEN BY THE ADVANCED COUNTRIES ON REDUCTION OF EMISSIONS OF OZONE DEPLETION SUBSTANCES IN VARIOUS BRANCHES OF ECONOMIC ACTIVITIES

3.3. An estimation of the undertaken efforts of rulling bodies RK on reduction of emissions in atmosphere ODS

For today the Republic Kazakhstan is the party of the Montreal report, accordingly there is a necessity for performance of obligations taken on. The given section is devoted to an estimation of measures applied in Kazakhstan on reduction of consumption OPB and transitive substances. Besides from the moment of signing the contract has passed enough time to tell on how many the measures are effective, used I in Kazakhstan for promotion in the market ozone safe substances and corresponding technologies, and whether am present necessity to application of other measures and strengthening available.

For performance of a task in view it is necessary to list the basic measures which have been undertaken in Kazakhstan for the decision of this question. It is necessary to note, that the basic positions of the Government of Kazakhstan contain in a question of protection of an ozone cloud and announcement of Strategy of reduction of consumption OPB in a number of acts, the international reports, the Ecological Code, the Concept of the project of the State program « the Effective utilization of energy and renewed resources of Republic Kazakhstan with a view of steady development till 2024 » and other documents, speech about which will go in following subitem [45].

3.3.1. The national legislation, the administrative and legal measures concerning protection of an ozone strata.

The government of Kazakhstan in November, 1999 issues the Decision № 1716 which component are the Regulations about import / export ODS substances and production containing ODS with appendices of Lists ODS and production containing ODS subject to state regulation [45].

According to article 2 point b the Viennese convention Kazakhstan takes necessary legislative or administrative measures under the control, restriction, reduction or prevention of activity of the person if this activity renders or can render adverse influence, changing or creating an opportunity of adverse change of a condition of an ozone cloud [45].

Introduction of system of sanctions of import / export OPB allows to adjust import OPB, the obligations of the country following from the Report and for prevention of illegal trade OPB both assistance to data gathering and representation of reports in Secretary on ozone [45].

In this connection the decision of Government RK³19 from January, 8, 2004 about introduction of system of licensing on import, export ODS and on detail connected with manufacture, repair and installation of equipment where it is used ODS which have been reconsidered and updated by the new Decision of the Government №508 from June, 18, 2007 [] is accepted.

To the sanction are subject:

- Import and export OD substances and production their containing;
- Manufacture of works with use OD substances and production containing them, and also repair, installation, service of the equipment working on OD substances.

To exclude a problem of " a technological waste dumping », in Kazakhstan restriction on import of the equipment, containing ODS is entered, by acceptance of the Decision №617 from June, 22, 2005. The given decision enters an interdiction on import ODS of the List And and the List In and on the equipment containing the given substances [45].

Consumption ODS is adjusted by the Ecological code of Republic of Kazakhstan (chapter 45): article 314 gives the general{common} requirements under the order of delivery of sanctions to import, export DS substances and production containing them, manufacture of works with use DS substances, repair, installation, service of the equipment containing DS substances, clause{article} 315-318 regulates requirements to consumption DS substances, including carrying out of annual inventory ODS [45].

3.3.2. Data presentation in Secretary on ozone.

Data presentation in Secretary on ozone has great value for maintenance of the control over performance of obligations of the Parties. Within the framework of the Montreal report data presentation is the legal obligation of each Party of the Montreal report Article 7) [].

The data have crucial importance by way of performance by the Parties of the accepted obligations, and at a national level allow to carry out the control strategy of stage-by-stage reduction OPB. The responsible persons accepting the decisions at a national level, without the authentic data cannot formulate corresponding measures on regulation of these substances, to develop realistic strategy of stage-by-stage reduction of application and to provide the necessary financial and technical help. Gathering and data presentation is one of the key problems arising during performance of the Montreal report. Therefore inventory and the analysis of the data is considered not only as the requirement, but also as the useful instrument in this important business [45].

Each Party{Side} annually submits data on all adjustable substances, including the data on consumption (application) on sectors, import, export and to manufacture OPB [45].

Alongside with annual reports on the data on adjustable substances, secretary of Fund the information on actions on maintenance of administrative and organizational support under Montreal report [45] is represented.

Besides within the framework of actions on preservation of an ozone cloud in our country the certificated rates on training and improvement of professional skill at the personnel of the firms connected to sale or service of a refrigerating machinery are organized. Such rates are the important making internal policy (strategy) as many questions connected to the legal moments, technical subtleties and other questions allow to inform up to the persons involved directly in sector where the infringements are possible{probable}. The important component of a rate is the explanation in necessity of transition on new DS substances, acquaintance with characteristics хладонов and their properties.

For the period since 2006 courses of improvement of qualification on training technical operation and safety of works with DS substances were passed by 176 persons, representatives of the largest companies, and also individual businessmen from all regions of Kazakhstan: "ИСПАТ-КАРМЕТ", joint-stock company « Steel Temirtau », firm « EES Support Services », « Marked YORK - KAZAKHSTAN », « Данон the Golden eagle », joint-stock company « Aluminium of Kazakhstan, joint-stock company " Вагонсервис ", ТД "Нафта", Open Company " Imagination " " Каганат ", « Тантай groups », « FSKY-SERVICE GROUP, "Салтек", « КвадроСервисЭлектроникс, "SungateСервис", « the East the Climate », « Air Energy Com », "Proline", "Climate - 7", "БытТехСервис", « EFFE group », « Технодом service », « Datex engineering », "Хладо-service", "Climate - control", "КазВентСервис", "Интерхолод", ИП "Ананчев", "Торопов", "Ниетпаев", etc.

Also within the framework of the designated actions at participation of the international organizations in Kazakhstan the complex of the equipment on extraction and clearing of old freon (forbidden 11 and 12), for its repeated use or recycling of a failed refrigerating machinery has been put. Within the framework of the Montreal contract such practice is supposed. It allows to support at a stage of a choice of the future refrigerating systems the available equipment in working order, to reduce internal deficiency of agents thus to lower risks of use of illicit production. It is considered, that at absence of the great demand, many manufacturers in the countries, not joined to the Montreal report, will refuse manufacture forbidden хладонов for the lack of demand for it, and will be compelled to reorient the manufactures on allowed HCFC. In this case reorientation of manufactures will demand from such countries of financial investments which they can receive from the World or International financial organizations, that actually conducts to the introduction of such countries into the Montreal contract.

3.4. Necessary actions for maintenance of the program of the Government.

From the previous chapter{head} it is possible to draw a conclusion, that as a whole in the country it is made much, for successful realization of the internal program on reduction of use ODS and to refusal of use of transitive substances.

The basic result which has been achieved is a full refusal of use 11 and 12 фреонов in 2005.

Now for Republic very important question, necessities of connection to other amendments to the basic contract is. In this question it is necessary to realize precise understanding of all consequences of such step for a national economy. There are many weighty arguments to detain, connection to the Copenhagen, Peking and Montreal amendments. But also is it is a lot of, reasons for the benefit of such step. First of all it is an opportunity to expect for financial support of solid financial institutions, and to increase the status of the country in opinion of world community. It is necessary to understand, that behind connection or refusal of connection well weighed policy based, on comprehension of the responsibility for concrete action is necessary. Besides it demands much, time for internal study of a question with the big stage of preparation of all legal and technical questions connected to the decision.

The precise control over Customs committee, the internal control over work of corresponding firms through licensing and certification allows to supervise this sector successfully. However, there is open a question of the reporting. Today the basic reporting is carried out on the basis of the information of Customs Committee and it is logical, as inside Republic there are no corresponding manufactures. However with transition to Transitive substances of group With, and use ozone safe agents, some of which, can quite be made on oil refineries, the level of such reporting will be insufficient.

Now speech already goes not only about the Montreal contract, it is known, that such substances have a more potential of global warming here again the clear data in frameworks Киотского of the report are required.

Pains of that, there is a probability, that with refusal of use of transitive substances mixes which contain small amount R22 will be used, and the account of them is required already. At a modern level of the reporting will check volumes of uses of mixes hardly and necessity will come, to take into account the charge such HCFC at a level of separate firms.

Today, for this step it is made much. Questions of domestic trade by emissions in frameworks of the Киотоо report are considered, the level of the reporting of each enterprise or firm raises. Also there are not few preconditions, that these actions finally will affect not only reduction of all emissions GHG in Republic, but also will lead to improvement of the internal reporting, so to the control over workmanship of legislative guidelines.

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