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Executive Committee of the
Interim Multilateral Fund for the
Implementation of the Montreal Protocol

Fifth Meeting
Montreal, 18-22 November 1991

PRELIMINARY EVALUATION OF THE USSR POTENTIAL IN-KIND CONTRIBUTION

PRELIMINARY EVALUATION OF THE POTENTIAL USSR IN-KIND CONTRIBUTION

Possible Mechanism for implementation of the In-Kind Contribution

1. This preliminary evaluation of the potential in-kind contribution should help the members of the Executive Committee in their deliberations.

2. Compliance with the control measures set out in Articles 2A and 2E of the Montreal Protocol:

- The proposed in-kind contribution would help Article 5, paragraph 1, countries to phase out controlled substances.

3. Consistence with the categories of agreed incremental costs:

- The indicative list of categories of incremental costs approved by the second meeting of the Parties includes the cost of converting of existing production facilities and the cost of establishing new production facilities for substitutes of capacity equivalent to capacity lost when plants are converted or scrapped. In both these cases, the cost of patents and designs, incremental cost of royalties, cost of training, as well as the cost of research to adopt technology to local circumstances, could be met by the proposed in-kind contribution.

- Under the 'end-use' section, the cost of recycling and providing technical assistance to reduce consumption and unintended emission of ODSs could be met by the proposed in-kind contribution.

4. Scope of application of proposed alternative technologies:

- Consideration of some advantages and limitations should be taken into account when reviewing the potential value of the in-kind contribution and its practical implications in phasing-out CFCs in countries operating under Article 5, paragraph 1. The scope for possible application of HCFC and HFC production technologies under the in-kind contribution scheme is limited to CFC-producing countries operating under Article 5, paragraph 1.

- CFC production is dominated by some US and European multinational corporations which control a substantial part of world CFC production capacity with proprietary rights over most processes.

- CFC production in Argentina, Brazil, Mexico and Venezuela is controlled by these multinationals through directly-owned subsidiaries. In Asia, technologies have either been licensed or sold to local firms in the private/public sector, except in China, where research and capabilities for production of some ODS substitutes are available. India, as a traditional partner of the USSR, can be considered as a country for potential application of Soviet HCFC/HFC technologies subject to its ratification of the Protocol.

- At the same time, dramatic growth of demand for CFCs and halons in developing countries is foreseen. Annual growth rates will range from 5 per cent to 15 per cent in the period 1992-2000. Projections for some particular countries show even more rapid growth - up to fifteen fold by 2015. The demand for production facilities and technology will consequently also grow.

- Halon consumption in developing countries is not very high in absolute terms but it represents a substantial proportion in terms of ozone depletion potential. For example, almost 40 per cent of China's total ODP consumption (46000 tonnes ODP) was for halons used in fire-fighting equipment.

5. Potential financial value:

- The potential financial value of the proposed USSR in-kind contribution should be assessed in terms of its potential ability to cover the USSR share of obligations (13 per cent of the Fund or, approximately $ 23 million if Ukraine and Byelorussia are included, the contribution would reach $ 26.8 million).

- The proposed technologies for some HCFC/HFC production are the components of the greatest potential financial value. The principal substitute for CFC-12 as a refrigerant is assumed HFC-134A. The capital costs of a HFC 134A unit of 5000 tonnes annual capacity is estimated at $ 30-40 million. The costs of technology transfer can reach up to 25-30 per cent of the capital costs.

- The cost of the halon recycling unit depends on its capacity, which in turn is defined by the level of total halon consumption in the country. Optimal capacity of halon recycling units should be 10 per cent of the total quantity of halons used. The estimation of the halon recycling unit cost of 20-50 tonnes annual capacity is about $50 thousand. The cost of other technologies proposed by the USSR can be estimated in a similar way.

- The costs of training sessions and demonstration projects for personnel from Article 5, paragraph 1, countries at USSR scientific and research institutes and industries can be estimated on the basis of similar projects implemented by UNEP and UNDP. It is assumed that transportation and living expenses will be covered by the USSR.

6. It is possible to establish mechanisms for payment in the form of services (UNEP/OzL.Pro/ExCom/5/12):

- through bilateral co-operation;

- with the participation of the executing agencies;

- on behalf of national executing agencies.

7. The following is the procedure for contributions in the form of services by the national executing agency:

(a) the national executing agency receives a license for the transmission of the technology for the production and use of CFC replacement services and releases;

(b) in the case of positive assessment of the proposed technologies, the national executing agency, co-operating, if necessary, with the executing agency (World Bank, PROON, UNEP):

  - distributes the advertising-commercial booklets to countries acting within the framework of Article 5, paragraph 1, of the Montreal Protocol and initiates the search for countries/recipients interested in receiving such technologies;

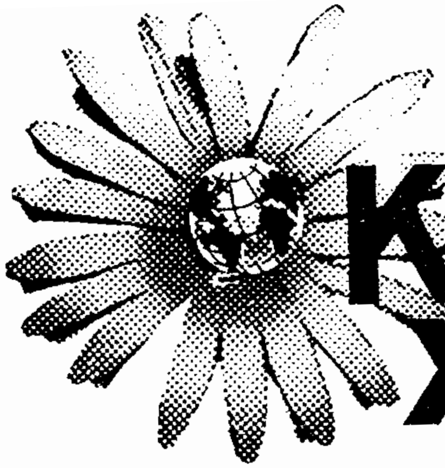
  - negotiates with possible countries/recipients. If an understanding on the question of transmission of the technology is reached with the country/recipient, the group signs the memorandum of intent and the agreement on confidentiality and non-dissemination of the know-how of the technology to be transferred;

  - on the basis of the memorandum of intent, it prepares and signs an agreement with the country/recipient on the transmission of the technology. The agreement specifies the terms and the composition of the technical documentation, the description of other services (design, training of personnel, supply of equipment, etc.), guarantees on reaching the designed capacity and quality of product.

(c) determines the cost in hard currency of the technical documentation to be transmitted, the know-how and other services. The cost is included in the amount of the contribution of the donor country to the Interim Multilateral Fund.

(d) the national executing agency organizes seminars for specialists from countries acting within the framework of Article 5, paragraph 1, of the Montreal Protocol;

(e) the national executing agency organizes training for specialists from the developing countries in technologies for the production and use of non-ozone-depleting substances on the basis of scientific-production associations in the country.



Khladon 22
Хладон 22

ХИМИЧЕСКОЕ НАЗВАНИЕ: ДИФТОРХЛОРМЕТАН

CHEMICAL NAME: DIFLUOROCHLOROMETHANE

Формула Chemical formula	CF_2CHI

ОСНОВНЫЕ ХАРАКТЕРИСТИКИ
MAIN CHARACTERISTICS

Молекулярная масса Molecular mass	86.5
Температура плавления, °C Melting point, °C	—157.4
Температура кипения, °C Boiling point, °C	—40.85
Критическая температура, °C Critical temperature, °C	96.15
Критическое давление, МПа Critical pressure, MPa	4.99
Критическая плотность, кг/м³ Critical density, kg/m³	513

ТЕПЛОФИЗИЧЕСКИЕ СВОЙСТВА В НОРМАЛЬНОЙ ТОЧКЕ КИПЕНИЯ
THERMOPHYSICAL PROPERTIES AT NORMAL BOILING POINT

Плотность, кг/м³ Density, kg/m³	
жидкость/liquid	1409
пар/vapor	4.7
Теплота испарения, кДж/кг Heat of vaporisation, kJ/kg	234
Энтальпия, кДж/кг Enthalpy, kJ/kg	
жидкость/liquid	454
пар/vapor	687
Энтропия, кДж/(кг·К) Entropy, kJ/(kg·K)	
жидкость/liquid	0.823
пар/vapor	1.823
Теплоемкость, C_p, кДж/(кг·К) Specific heat, C_p, kJ/(kg·K)	
жидкость/liquid	1.103
пар/vapor	0.617
Теплопроводность, мкПа·с Thermal conductivity, μPa·s	
жидкость/liquid	116
пар/vapor	6.9
Вязкость, мВт/(м·К) Viscosity, mW/(m·K)	
жидкость/liquid	332
пар/vapor	10.2
Поверхностное натяжение, мН/м Surface tension, mN/m	17.9

ДРУГИЕ ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА
OTHER PHYSICO-CHEMICAL PROPERTIES

Теплота образования стандартная (идеальный газ при 25 °C), кДж/моль Standard heat of formation (ideal gas at 25 °C), kJ/mole	—475
Дипольный момент, Кл·м (D) Dipole moment, C·m (D)	$4.7 \cdot 10^{-30}$ (1.41)
Показатель преломления, n_D^{20} Refractive index, n_D^{20}	1.267
Токсичность, млн⁻¹ (по объему) Toxicity, ppm (by vol.)	1000 (TLV)
Горючесть Flammability	не горюч non-flammable
Потенциал глобального потепления Global warming potential	0.4
Озоноразрушающий потенциал Ozone depletion potential	0.05

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Research-Production Association,

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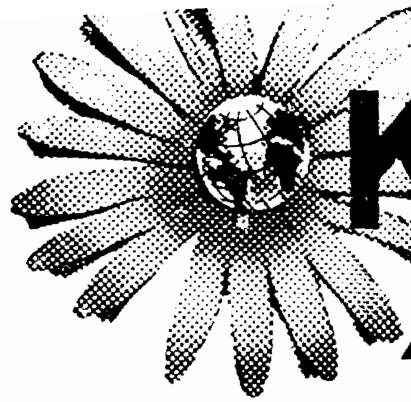

Khladon 123
хладон 123

ХИМИЧЕСКОЕ НАЗВАНИЕ:
1,1,1-ТРИФТОРДИХЛОРЭТАН
CHEMICAL NAME:
1,1,1-TRIFLUORODICHLOROETHANE

Формула Chemical formula	CF_3CCl_2H

ОСНОВНЫЕ ХАРАКТЕРИСТИКИ
MAIN CHARACTERISTICS

Молекулярная масса Molecular mass	152.9
Температура плавления, °C Melting point, °C	—107
Температура кипения, °C Boiling point, °C	27.8
Критическая температура, °C Critical temperature, °C	183.8
Критическое давление, МПа Critical pressure, MPa	3.674
Критическая плотность, кг/м³ Critical density, kg/m³	550

ТЕПЛОФИЗИЧЕСКИЕ СВОЙСТВА В НОРМАЛЬНОЙ ТОЧКЕ КИПЕНИЯ
THERMOPHYSICAL PROPERTIES AT NORMAL BOILING POINT

Плотность, кг/м³ Density, kg/m³	
жидкость/liquid	1456
пар/vapor	6.4
Теплота испарения, кДж/кг Heat of vaporisation, kJ/kg	167
Энтальпия, кДж/кг Enthalpy, kJ/kg	
жидкость/liquid	323
пар/vapor	490
Энтропия, кДж/(кг·К) Entropy, kJ/(kg·K)	
жидкость/liquid	3.32
пар/vapor	3.89
Теплоемкость, C_p, кДж/(кг·К) Specific heat, C_p, kJ/(kg·K)	
жидкость/liquid	1.03
пар/vapor	0.70
Теплопроводность, мкПа·с Thermal conductivity, µPa·s	
жидкость/liquid	72
пар/vapor	9.4
Вязкость, мВт/(м·К) Viscosity, mW/(m·K)	
жидкость/liquid	421
пар/vapor	8.1
Поверхностное натяжение, мН/м Surface tension, mN/m	15.0

ДРУГИЕ ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА
OTHER PHYSICO-CHEMICAL PROPERTIES

Теплота образования стандартная (идеальный газ при 25 °C), кДж/моль Standard heat of formation (ideal gas at 25 °C), kJ/mole	—740
Дипольный момент, Кл·м (D) Dipole moment, C·m (D)	
Показатель преломления, n_D^{15} Refractive index, n_D^{15}	1.3332
Токсичность, млн⁻¹ (по объему) Toxicity, ppm (by vol.)	100 (AEL)
Горючесть Flammability	не горюч non-flammable
Потенциал глобального потепления Global warming potential	
Озоноразрушающий потенциал Ozone depletion potential	0.02

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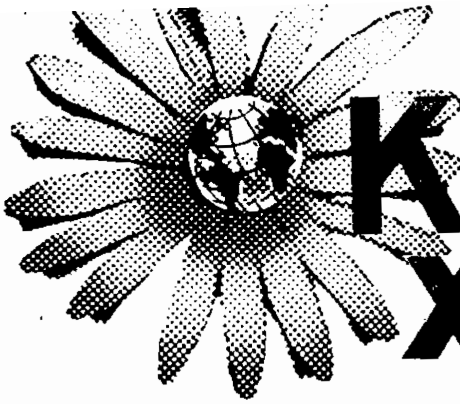

Khladon 125
Хладон 125

ХИМИЧЕСКОЕ НАЗВАНИЕ: ПЕНТАФТОРЭТАН
CHEMICAL NAME: PENTAFLUOROETHANE

Формула Chemical formula	CF_3CF_2H

ОСНОВНЫЕ ХАРАКТЕРИСТИКИ
MAIN CHARACTERISTICS

Молекулярная масса Molecular mass	120.0
Температура плавления, °C Melting point, °C	—103
Температура кипения, °C Boiling point, °C	—48.5
Критическая температура, °C Critical temperature, °C	66.25
Критическое давление, МПа Critical pressure, MPa	3.63
Критическая плотность, кг/м³ Critical density, kg/m³	571

ТЕПЛОФИЗИЧЕСКИЕ СВОЙСТВА В НОРМАЛЬНОЙ ТОЧКЕ КИПЕНИЯ
THERMOPHYSICAL PROPERTIES AT NORMAL BOILING POINT

Плотность, кг/м³ Density, kg/m³	
жидкость/liquid	1515
пар/vapor	6.7
Теплота испарения, кДж/кг Heat of vaporisation, kJ/kg	157
Энтальпия, кДж/кг Enthalpy, kJ/kg	
жидкость/liquid	318
пар/vapor	475
Энтропия, кДж/(кг·К) Entropy, kJ/(kg·K)	
жидкость/liquid	3.18
пар/vapor	3.88
Теплоемкость, C_p, кДж/(кг·К) Specific heat, C_p, kJ/(kg·K)	
жидкость/liquid	1.09
пар/vapor	0.69
Теплопроводность, мкПа·с Thermal conductivity, μPa·s	
жидкость/liquid	77
пар/vapor	8.4
Вязкость, мВт/(м·К) Viscosity, mW/(m·K)	
жидкость/liquid	380
пар/vapor	9.6
Поверхностное натяжение, мН/м Surface tension, mN/m	12.8

ДРУГИЕ ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА
OTHER PHYSICO-CHEMICAL PROPERTIES

Теплота образования стандартная (идеальный газ при 25°C), кДж/моль Standard heat of formation (ideal gas at 25°C), kJ/mole	—1123
Дипольный момент, Кл·м (D) Dipole moment, C·m (D)	$5.1\cdot10^{-30}$ (1.54)
Показатель преломления, n_D^{t0} Refractive index, n_D^{t0}	1.5012
Токсичность, млн⁻¹ (по объему) Toxicity, ppm (by vol.)	1000 (AEL)
Горючесть Flammability	не горюч non-flammable
Потенциал глобального потепления Global warming potential	0.5
Озоноразрушающий потенциал Ozone depletion potential	0

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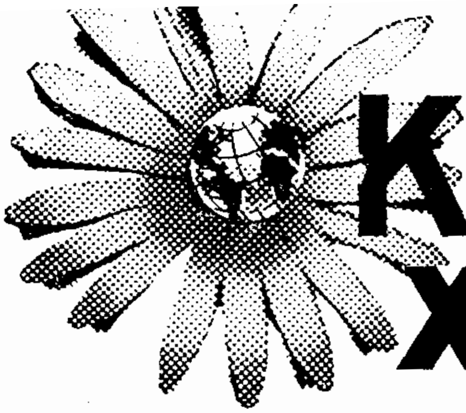

Khladon 134A
хладон 134A

ХИМИЧЕСКОЕ НАЗВАНИЕ:
1,1,1,2-ТЕТРАФТОРЭТАН
CHEMICAL NAME:
1,1,1,2-TETRAFLUOROETHANE

Формула Chemical formula	CF_3CFH_2

ОСНОВНЫЕ ХАРАКТЕРИСТИКИ
MAIN CHARACTERISTICS

Молекулярная масса Molecular mass	102.0
Температура плавления, °C Melting point, °C	—101
Температура кипения, °C Boiling point, °C	—26.1
Критическая температура, °C Critical temperature, °C	101
Критическое давление, МПа Critical pressure, MPa	4.06
Критическая плотность, кг/м³ Critical density, kg/m³	515

ТЕПЛОФИЗИЧЕСКИЕ СВОЙСТВА В НОРМАЛЬНОЙ ТОЧКЕ КИПЕНИЯ
THERMOPHYSICAL PROPERTIES AT NORMAL BOILING POINT

Плотность, кг/м³ Density, kg/m³	
жидкость/liquid	1373
пар/vapor	5.2
Теплота испарения, кДж/кг Heat of vaporisation, kJ/kg	217
Энтальпия, кДж/кг Enthalpy, kJ/kg	
жидкость/liquid	356
пар/vapor	573
Энтропия, кДж/(кг·К) Entropy, kJ/(kg·K)	
жидкость/liquid	3.30
пар/vapor	4.18
Теплоемкость, C_p, кДж/(кг·К) Specific heat, C_p, kJ/(kg·K)	
жидкость/liquid	1.31
пар/vapor	0.78
Теплопроводность, мкПа·с Thermal conductivity, μPa·s	
жидкость/liquid	103
пар/vapor	9.4
Вязкость, мВт/(м·К) Viscosity, mW/(m·K)	
жидкость/liquid	404
пар/vapor	9.9
Поверхностное натяжение, мН/м Surface tension, mN/m	16.1

ДРУГИЕ ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА
OTHER PHYSICO-CHEMICAL PROPERTIES

Теплота образования стандартная (идеальный газ при 25 °C), кДж/моль Standard heat of formation (ideal gas at 25 °C), kJ/mole	—923
Дипольный момент, Кл·м (D) Dipole moment, C·m (D)	$6.0 \cdot 10^{-30}$ (1.80)
Показатель преломления, n_D Refractive index, n_D	
Токсичность, млн⁻¹ (по объему) Toxicity, ppm (by vol.)	1000 (AEL)
Горючесть Flammability	не горюч non-flammable
Потенциал глобального потепления Global warming potential	0.2
Озоноразрушающий потенциал Ozone depletion potential	0

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The All – Union Scientific Research Institute
for Fire Protection, USSR Ministry of the Interior

FIRE EXTINGUISHING AEROSOL GENERATORS FOR TOTAL FLOODING SYSTEMS

Moscow 1990

Fire Extinguishing Aerosol Generators for Total Flooding Systems

Field of application

Fire extinguishing aerosol generators (FEAG) with self-activating extinguishing compositions (SAEC) are operating units of total flooding systems designed to extinguish classes A2,B,C,E fires (gaseous,liquid and solid flammable substances and electrical appliances) in industrial rooms and warehouses,on railroad and automobile transport,ships and aircraft.

Principle of action

Gas-aerosol mixture generation (inert gases and ultra-dispersed aerosol particles) which has a high inhibitory effect on organic substances burning process in air oxygen is a principle of action of FEAG.

SAEC and FEAG advantages

The highest extinction effectiveness compared with all known total flooding extinguishing means (flow rate of SAEC composition is one-sixth/one-eighth as many as and FEAG weight and dimensions are one-eighth/one-twelfth as large as those of Halon extinguishing systems.

The ecological safety,lack of the ozone layer depleting effect,the endurable toxic level in fire extinction concentrations.

The capability to prevent vapor- and gas-air mixtures explosions in volume after extinction.

The lower corrosive activity compared with Halon concerning metallic materials.

The lack of pipelines and complex locking-starting fitting.

Possible use with fire detection systems.

High reliability with constant availability for service.

Wide range of operation conditions allowing to use the units in any climatic area,aggressive environment and at high vibration.

Wide raw-material and manufacturing base in the USSR.

Simple maintenance,elimination of possible extinguishing agents leakage and high reliability of extinguishing systems.

SAEC performances used in FEAG

Fire extinguishing concentrations (in air) for combustible substances are the following:
40-100g/ m^3 for solids
50-100g/ m^3 for liquids
40-180g/ m^3 for gaseous substances.

Inerting concentrations for mixtures of combustible gases with air are not more than:
50g/ m^3 for methane
230g/ m^3 for hydrogen.

Compression strength of SAEC fire extinguishing charge is not less than 5-30MPa.

Rupture strength of SAEC fire extinguishing charge is not less than 3-5MPa.

Weight and dimensions of SAEC fire extinguishing charge are not limited.

The hazard factor of toxic effect on living beings is 0 in fire extinguishing concentrations.

FEAG performances

SAEC fire extinguishing charge weight in one FEAG is from 0.02-15.00kg.

FEAG weight (without SAEC) is from 0.01 to 8.00 kg.

FEAG operation time is from 1 to 120 s.

The volume of a room protected by one FEAG is 80 m^3.

The method to put FEAG into action is electrical and mechanical.

The temperature range of storage and operation is from -70°C to +70°C.

The atmospheric relative humidity at FEAG operation is up to 100%.

The absolute environmental pressure is 10^3 Pa and more.

The guaranteed storage and operation period is more than 10 years.

ODP - zero

LC50 - 200 g/m^3 under the 60 minutes exposition

Corrosion rate is low and doesn't exceed 0.001 mm p/year for steel, brass, aluminium, duraluminium ahd copper

Commercial production of FEAG and SAEC charges is launched at manufactures of All-Union Scientific Research Institute for Fire Protection (VNIIPO), the Applied Chemistry Research Institute (ACRI), the Special Design-Technology Bureau (SDTB) "Technolog" of the Lensoviet Leningrad Technological Institute (LLTI) and the Mintz Radiotechnical Institute (RTI).

VNIIPO in cooperation with ACRI, SDTB "Technolog" and Mintz RTI offers:

standard FEAG supply for total flooding systems;

FEAG development for total flooding systems according to customer's requirements including Halon extinguishing systems substitution;

development of FEAG design engineering specifications for total flooding systems;

FEAG commercial production organization and its supply to customers;

development of automated extinguishing systems with FEAG integration.

Please address a proposal to:

143900, Moscow region, Balashikha-6, VNIIPO
Telephone 521-27-00, Teletype "Temp"