COMMISSION OF THE EUROPEAN COMMUNITIES

COM(91) 268 final

Brussels, 17 July 1991

PROPOSAL FOR A COUNCIL DECISION ON ACCESSION BY THE EUROPEAN ECONOMIC COMMUNITY TO THE PROTOCOL TO THE GENEVA CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION ON THE REDUCTION OF EMISSIONS OF NITROGEN OXIDES OR THEIR TRANSBOUNDARY FLUXES

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. Introduction

The Community and all the Member States are contracting parties to the Convention on long-range transboundary air pollution (1979 Geneva Convention), as drawn up by the Economic Commission for Europe of the United Nations.

The Protocol on the reduction of emissions of nitrogen oxides (NOx) or their transboundary fluxes was established as part of that Convention.

The Community has extensive legislation on the control of air pollution which, tightened up where necessary, should enable the Community to meet the fundamental obligations laid down by the NOx Protocol.

Eleven of the Community Member States have signed the NOx Protocol.

The Commission proposes that the Council should decide on accession by the European Economic Community to the Protocol on the reduction of emissions of nitrogen oxides or their transboundary fluxes.

2. The NOx Protocol

In its fundamental obligations the NOx Protocol provides that the contracting parties should, as a first step and as soon as possible, take effective measures to control and/or reduce their annual national emissions of nitrogen oxides or their transboundary fluxes, to the effect that, by 31 December 1994 at the latest, the latter are not higher than their annual national emissions of nitrogen oxides or the transboundary fluxes of these emissions during the 1987 calendar year or any other previous year to be specified on signature of the Protocol or accession thereto, on condition that, as regards any contracting party specifying any previous year, its transboundary national fluxes or its national emissions of nitrogen oxides over the period from 1 January 1987 to 1 January 1996 do not exceed, on annual average, its transboundary fluxes or its national emissions for the 1987 calendar year.

Furthermore, these obligations are completed two years after entry into force of the Protocol by the following measures:

- application of emission standards for new fixed and mobile sources based on the best available and economically acceptable technologies;
- adoption of anti-pollution measures for existing large fixed sources.

The contracting parties undertook to negotiate, six months after the entry into force of the Protocol (July 1991) more rigorous measures, and in particular, reductions in national annual emissions based on internationally acceptable critical loads.

The Protocol also provides for measures geared to:

- technology exchange;
- adequate availability of unleaded fuel;
- diverse research and monitoring activities;
- exchange of information and notification to the executive body of the programmes, policies and strategies which the contracting parties are obliged to establish.

3. COMMUNITY LEGAL PROVISIONS CONCERNED

3.1 Existing directives

The Community has already adopted the following legal provisions designed to reduce the emissions of NOx and to control their concentrations in the air:

(a) Directive 84/360/EEC on the combating of air pollution from industrial plants;[1]
(b) Directive 85/203/EEC on air quality standards for nitorgen dioxide;[2]
(c) Directive 85/210/EEC on the approximation of the laws of the Member States concerning the lead content of petrol;[3]
(d) Directives 88/76/EEC and 89/458/EEC on air pollution from private cars and small capacity (less than 1400 cc) private cars respectively;[4]
(e) Directive 88/77/EEC on air pollution from utility vehicles;[5]
(f) Directive 88/609/EEC on the limitation of emissions of certain pollutants into the air from large combustion plants.[6]

These measures should enable the Community to meet its obligations concerning the stabilization of NOx emissions and, in particular, the obligations to:

- establish emission standards for certain new fixed sources (f) on the basis of the best available technologies;
- establish emission standards for certain new mobile sources (d and e) on the basis of the best available technologies;
- adopt anti-pollution measures for certain existing fixed sources (a and f);
- use the best available technology not involving excessive costs (fixed sources) (a);
- introduce unleaded petrol in general in the Community (c).

---

1 OJ No L 188, 16.7.1984, p. 20.
2 OJ No L 87, 27.3.1985, p.1.
3 OJ No L 372, 31.12.1985, p. 37.
4 OJ No L 36, 9.2.1988, p. 1
OJ No L 226, 3.8.1989, p. 1.
5 OJ No L 36, 9.2.1988, p. 33.
6 OJ No L 336, 7.12.1988, p. 1

3.2 Development of Community legislation and future work on the control of NOx emissions

At meetings held in December 1990 and March 1991 the Council agreed to tighten up the legislation on emissions of certain pollutants into the air from private cars and heavy goods vehicles.

Furthermore, the Commission plans shortly to submit to the Council a proposal on the limitation of air pollution due to gas turbines.

A number of other policies pursued by the Community in energy or research will enable it to participate in an exchange of technologies and in the work to be undertaken as part of the Protocol.

3.3 NOx emissions in the Community

As part of the CORINAIR programme, the Commission has drawn up an inventory of emissions of SO_2, NOx and volatile organic compounds for the year 1985.

For the major categories of emitters the picture for NOx emissions is as follows:

Sources	Emissions (kt)	NOx (%)
Traffic	5 422	50
Large combustion plants (> 50 MW)	3 987	37
Others	1 471	13
TOTAL	10 880	100

Table 1: Emissions of NOx in the Community in 1985

Some experts[2] felt that the value attributed to NOx emissions from traffic was slightly underestimated and proposed a value of 6237 kt, which would bring the total to 11 695 kt.

The Commission does not have the corresponding figures for 1987.

Under the Geneva Convention the contracting parties must give notice of their annual emission levels.

1 Residential and services, industrial processes.

2 Study on the forecast of emissions from motor vehicles in the European [illegible]

The figures available for 1985 and 1987 are 11 400 kt and 11 659 kt respectively.[3] If, to take account of German unification, the figures supplied by the GDR are added, the totals come to 12 355 kt and 12 660 kt.

As regards the 1987 values, Greece and Spain had not yet communicated their emission levels and thus for these two countries the 1985 emission levels were simply added to the 1987 totals.

Any difference for these two countries between 1985 and 1987 would probably show a slight increase in emissions.

The approach taken is to keep, for 1987, the 1985 figures, which are lower than the level provided for by the Protocol and hence more stringent in terms of the total emission level to be taken by the Community as a basis for stabilization.

Table 2 indicates the information available for emissions in 1985 and 1987.

	CORINAIR	COR/SAM[1]	UN-ECE[2]	UN-ECE/GDR[3]
85 (kt)	10880	11695	11400	12355
87 (kt)	-	-	11659	12660*

Table 2: Inventories of NO_x emissions available for 1985 and 1987

At present the best inventories of NO_x have a margin of error of around 15%.

The figures in the various inventories of NO_x emissions in the Community in 1985 are within this margin of error.

For 1987 the Community level finally adopted of NO_x emissions (including the GDR) will be 12660 kt.

The forecast for NO_x emissions for the Protocol target year, i.e. 1994, is based on the following hypotheses:

1. The number of vehicles is extrapolated from the trend between 1970 and 1985 and from a number of socioeconomic parameters (GDP, number of households, road network, etc.).

3 EB.AIR/GE.I/16/Add.1.

1 CORINAIR values amended in accordance with SAMARAS *et al.*
2 Values communicated by the contracting parties to the Geneva Convention (Community total).
3 Ditto + GDR.
* Value taken for the reference year (1987)

2. The estimate of emissions due to traffic takes account of directives already adopted by the Council, of proposals for directives made by the Commission[4] and of accelerated measures taken by some Member States.

3. The directive on large combustion plants sets NO_x emission reduction targets for all the Member States to be achieved, for existing plants, in 1993 and 1998.

   Some Member States can take advantage of an additional period of two years (Germany + former GDR: 3 years) to achieve the 1993 target.

4. New plants put into service up to 1992 are counted as existing plants.

   Only plants put into service between 1992 and 1995 are regarded as new plants.

   They comply with the emission limits laid down by the Directive. Plant capacity of some 10 600 MWe is likely tobe brought into service in the Community between 1992 and 1995.

5. Taking all types of fuel together, the increase in consumption is estimated at 9.6% for industrial processes and 15% for the residential and services sector.

   However, this estmate does not take account of reductions that might be achieved in some Member States.

6. The NO_x emission figures for the former East Germany are kept at their 1987 level of 1 001 kt (probably a conservative hypothesis).

   The estimated emissions of NO_x in the Community in 1994 are as follows:

Sources	Emissions
GDR	1001
Traffic	6751
Large combustion plants	3452
Others	1632
Total	12836*

Table 3: Estimates of emissions of NO_x in the Community in 1994

4. CONCLUSION

A look at the figures* in Tables 2 and 3 shows that for 1994 the emission levels of NO_x in the Community will be barely higher than in 1987.

4 OJ No C 81, 30.3.1990;
COM(90)174 final.

* Estimated value for the target year (end of 1994).

However, given a number of stringent hypotheses taken and a margin of error inherent in forecasts of emissions of this type of pollutant which are far
greater than this slight increase, the Commission takes the view that the Community is already in a position to stabilize its emissions of NO_x by 1994 at the 1987 level. Where necessary, in the light of future inventories, the Commission will put forward additional measures to reduce emissions to fulfil this obligation.

With the exception of Portugal all the Member States have signed the NO_x Protocol.[1] In addition, some Member States have signed a declaration announcing their intention to reduce, by 1998 at the latest, their annual level of NO_x emissions by 30%, this reduction being calculated on the basis of the level of emissions in any year between 1980 and 1986.

The Commission therefore feels that the Community will be technically able to meet the obligations of the NO_x Protocol. It is also important that the Community should make a concrete commitment, at international level, to the combating of transboundary air pollution, including the more stringent measures provided for by the NO_x protocol, thereby effectively assuming the responsibilities incumbent upon it. The Commission thus proposes that the Council adopt this decision.

1 As at 1 October 1990 only France and the Netherlands had ratified the NOx Protocol.

Council Decision of ... on the accession of the Community to the Protocol to the Geneva Convention on long-range transboundary air pollution on the reduction of emissions on nitrogen oxides or their transboundary fluxes

THE COUNCIL OF THE EUROPEAN COMMUNITIES,
Having regard to the Treaty establishing the European Economic Community, and in particular Article 130s thereof,
Having regard to the proposal from the Commission,
Having regard to the opinion of the European Parliament,
Having regard to the opinion of the Economic and Social Committee,

Whereas Article 130r(5) of the Treaty calls for active cooperation by the Community and the Member States in international measures to protect the environment; whereas, because of the transboundary nature of air pollution, it is in the interest of the Community to participate in international measures designed to reduce this pollution;

Whereas the Community is a contracting party to the Convention of the Economic Commission for Europe of the United Nations on long-range transboundary air pollution (1979 Geneva Convention)[1] and to one of its Protocols on the financing of EMEP (Cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe);[2]

Whereas Article 130r(2) of the Treaty states that measures by the Community should be based on the principles of preventive action and correction at source, as a priority, of damage to the environment; whereas these principles have been enshrined, as regards air pollution, by several Community legal acts on the reduction of emissions of nitrogen oxides from the main sources (motor vehicles and large combustion plants);

Whereas the principle of correction at source is one of the objectives of the NOx Protocol to the Convention, which lays down in particular a general objective of stabilizing total emissions of nitrogen oxides and provides for the application of emission standards and adoption of anti-pollution measures, while reserving the right to tighten up obligations for subsequent negotiations;

Whereas use of the best available technology, as set out in the fundamental obligations of the protocol, has been enshrined since 1984 in Community law on the combating of air pollution of an industrial origin; whereas this same principle has become, since 1989, the basic philosophy for reducing emissions from motor vehicles;

Whereas, in view of the damage caused to the environment and in the light of the transboundary nature of long-range air pollution due to emissions of nitrogen oxides, there should be joint action at international level; whereas the Community should accede to the Protocol on the reduction of emissions of nitrogen oxides or their transboundary fluxes.

1 OJ No L 171, 27.6.1981, p. 11.

HAS DECIDED AS FOLLOWS:

Article 1

The European Economic Community hereby accedes to the Protocol to the 1979 Convention on long-range transboundary air pollution on the reduction of emissions of nitrogen oxides or their transboundary fluxes.

The text of the said Protocol is attached to this decision.

Article 2

The President of the Council shall deposit the instruments in accordance with Article 14 of the Protocol.

Done at Brussels,

For the Council

The President

PROTOCOL TO THE 1979 CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION AIR POLLUTION CONCERNING THE CONTROL OF EMISSIONS OF NITROGEN OXIDES OR THEIR TRANSBOUNDARY FLUXES

The Parties,

Determined to implement the Convention on Long-range Transboundary Air Pollution,

Concerned that present emissions of air pollutants are causing damage, in exposed parts of Europe and North America, to natural resources of vital environmental and economic importance,

Recalling that the Executive Body for the Convention recognized at its second session the need to reduce effectively the total annual emissions of nitrogen oxides from stationary and mobile sources or their transboundary fluxes by 1995, and the need on the part of other States that had already made progress in reducing these emissions to maintain and review their emission standards for nitrogen oxides,

Taking into consideration existing scientific and technical data on emissions, atmospheric movements and effects on the environment of nitrogen oxides and their secondary products, as well as on control technologies,

Conscious that the adverse environmental effects of emissions of nitrogen oxides vary among countries,

Determined to take effective action to control and reduce national annual emissions of nitrogen oxides or their transboundary fluxes by, in particular, the application of appropriate national emission standards to new mobile and major new stationary sources and the retrofitting of existing major stationary sources,

Recognizing that scientific and technical knowledge of these matters is developing and that it will be necessary to take such developments into account when reviewing the operation of this Protocol and deciding on further action,

Noting that the elaboration of an approach based on critical loads is aimed at the establishment of an effect-oriented scientific basis to be taken into account when reviewing the operation of this Protocol and at deciding on further internationally agreed measures to limit and reduce emissions of nitrogen oxides or their transboundary fluxes,

Recognizing that the expeditious consideration of procedures to create more favourable conditions for exchange of technology will contribute to the effective reduction of emissions of nitrogen oxides in the region of the Commission,

Noting with appreciation the mutual commitment undertaken by several countries to implement immediate and substantial reductions of national annual emissions of nitrogen oxides,

Acknowledging the measures already taken by some countries which have had the effect of reducing emissions of nitrogen oxides,

Have agreed as follows:

Article 1

Definitions

For the purposes of the present Protocol,

1. "Convention" means the Convention on Long-range Transboundary Air Pollution, adopted in Geneva on 13 November 1979;

2. "EMEP" means the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe;

3. "Executive Body" means the Executive Body for the Convention constituted under article 10, paragraph 1 of the Convention;

4. "Geographical scope of EMEP" means the area defined in article 1, paragraph 4 of the Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Long-term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), adopted in Geneva on 28 September 1984;

5. "Parties" means, unless the context otherwise requires, the Parties to the present Protocol;

6. "Commission" means the United Nations Economic Commission for Europe;

7. "Critical load" means a quantitative estimate of the exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge;

8. "Major existing stationary source" means any existing stationary source the thermal input of which is at least 100 MW;

9. "Major new stationary source" means any new stationary source the thermal input of which is at least 50 MW;

10. "Major source category" means any category of sources which emit or may emit air pollutants in the form of nitrogen oxides, including the categories described in the Technical Annex, and which contribute at least 10 per cent of

the total national emissions of nitrogen oxides on an annual basis as measured or calculated in the first calendar year after the date of entry into force of the present Protocol, and every fourth year thereafter;

11. "New stationary source" means any stationary source the construction or substantial modification of which is commenced after the expiration of two years from the date of entry into force of this Protocol;

12. "New mobile source" means a motor vehicle or other mobile source which is manufactured after the expiration of two years from the date of entry into force of the present Protocol.

Article 2

Basic obligations

1. The Parties shall, as soon as possible and as a first step, take effective measures to control and/or reduce their national annual emissions of nitrogen oxides or their transboundary fluxes so that these, at the latest by 31 December 1994, do not exceed their national annual emissions of nitrogen oxides or transboundary fluxes of such emissions for the calendar year 1987 or any previous year to be specified upon signature of, or accession to, the Protocol, provided that in addition, with respect to any Party specifying such a previous year, its national average annual transboundary fluxes or national average annual emissions of nitrogen oxides for the period from 1 January 1987 to 1 January 1996 do not exceed its transboundary fluxes or national emissions for the calendar year 1987.

2. Furthermore, the Parties shall in particular, and no later than two years after the date of entry into force of the present Protocol:

(a) Apply national emissions standards to major new stationary sources and/or source categories, and to substantially modified stationary sources in major source categories, based on the best available technologies which are economically feasible, taking into consideration the Technical Annex;

(b) Apply national emission standards to new mobile sources in all major source categories based on the best available technologies which are economically feasible, taking into consideration the Technical Annex and the relevant decisions taken within the framework of the Inland Transport Committee of the Commission; and

(c) Introduce pollution control measures for major existing stationary sources, taking into consideration the Technical Annex and the characteristics of the plant, its age and its rate of utilization and the need to avoid undue operational disruption.

3. (a) The Parties shall, as a second step, commence negotiations, no later than six months after the date of entry into force of the present Protocol, on

further steps to reduce national annual emissions of nitrogen oxides or transboundary fluxes of such emissions, taking into account the best available scientific and technological developments, internationally accepted critical loads and other elements resulting from the work programme undertaken under article 6.

(b) To this end, the Parties shall co-operate in order to establish:

(i) Critical loads;

(ii) Reductions in national annual emissions of nitrogen oxides or transboundary fluxes of such emissions as required to achieve agreed objectives based on critical loads; and

(iii) Measures and a time-table commencing no later than 1 January 1996 for achieving such reductions.

4. Parties may take more stringent measures than those required by the present article.

Article 3

Exchange of technology

1. The Parties shall, consistent with their national laws, regulations and practices, facilitate the exchange of technology to reduce emissions of nitrogen oxides, particularly through the promotion of:

(a) Commercial exchange of available technology;

(b) Direct industrial contacts and co-operation, including joint ventures;

(c) Exchange of information and experience; and

(d) Provision of technical assistance.

2. In promoting the activities specified in subparagraphs (a) to (d) above, the Parties shall create favourable conditions by facilitating contacts and co-operation among appropriate organizations and individuals in the private and public sectors that are capable of providing technology, design and engineering services, equipment or finance.

3. The Parties shall, no later than six months after the date of entry into force of the present Protocol, commence consideration of procedures to create more favourable conditions for the exchange of technology to reduce emissions of nitrogen oxides.

Article 4

Unleaded fuel

The Parties shall, as soon as possible and no later than two years after the date of entry into force of the present Protocol, make unleaded fuel sufficiently available, in particular cases as a minimum along main international transit routes, to facilitate the circulation of vehicles equipped with catalytic converters.

Article 5

Review process

1. The Parties shall regularly review the present Protocol, taking into account the best available scientific substantiation and technological development.

2. The first review shall take place no later than one year after the date of entry into force of the present Protocol.

Article 6

Work to be undertaken

The Parties shall give high priority to research and monitoring related to the development and application of an approach based on critical loads to determine, on a scientific basis, necessary reductions in emissions of nitrogen oxides. The Parties shall, in particular, through national research programmes, in the work plan of the Executive Body and through other co-operative programmes within the framework of the Convention, seek to:

(a) Identify and quantify effects of emissions of nitrogen oxides on humans, plant and animal life, waters, soils and materials, taking into account the impact on these of nitrogen oxides from sources other than atmospheric deposition;

(b) Determine the geographical distribution of sensitive areas;

(c) Develop measurements and model calculations including harmonized methodologies for the calculation of emissions, to quantify the long-range transport of nitrogen oxides and related pollutants;

(d) Improve estimates of the performance and costs of technologies for control of emissions of nitrogen oxides and record the development of improved and new technologies; and

(e) Develop, in the context of an approach based on critical loads, methods to integrate scientific, technical and economic data in order to determine appropriate control strategies.

Article 7

National programmes, policies and strategies

The Parties shall develop without undue delay national programmes, policies and strategies to implement the obligations under the present Protocol that shall serve as a means of controlling and reducing emissions of nitrogen oxides or their transboundary fluxes.

Article 8

Information exchange and annual reporting

1. The Parties shall exchange information by notifying the Executive Body of the national programmes, policies and strategies that they develop in accordance with article 7 and by reporting to it annually on progress achieved under, and any changes to, those programmes, policies and strategies, and in particular on:

(a) The levels of national annual emissions of nitrogen oxides and the basis upon which they have been calculated;

(b) Progress in applying national emission standards required under article 2, subparagraphs 2 (a) and 2 (b), and the national emission standards applied or to be applied, and the sources and/or source categories concerned;

(c) Progress in introducing the pollution control measures required under article 2, subparagraph 2 (c), the sources concerned and the measures introduced or to be introduced;

(d) Progress in making unleaded fuel available;

(e) Measures taken to facilitate the exchange of technology; and

(f) Progress in establishing critical loads.

2. Such information shall, as far as possible, be submitted in accordance with a uniform reporting framework.

Article 9

Calculations

EMEP shall, utilizing appropriate models and in good time before the annual meetings of the Executive Body, provide to the Executive Body calculations of nitrogen budgets and also of transboundary fluxes and deposition of nitrogen oxides within the geographical scope of EMEP. In areas outside the geographical scope of EMEP, models appropriate to the particular circumstances of Parties to the Convention therein shall be used.

Article 10

Technical Annex

The Technical Annex to the present Protocol is recommendatory in character. It shall form an integral part of the Protocol.

Article 11

Amendments to the Protocol

1. Any Party may propose amendments to the present Protocol.

2. Proposed amendments shall be submitted in writing to the Executive Secretary of the Commission who shall communicate them to all Parties. The Executive Body shall discuss the proposed amendments at its next annual meeting provided that these proposals have been circulated by the Executive Secretary to the Parties at least ninety days in advance.

3. Amendments to the Protocol, other than amendments to its Technical Annex, shall be adopted by consensus of the Parties present at a meeting of the Executive Body, and shall enter into force for the Parties which have accepted them on the ninetieth day after the date on which two-thirds of the Parties have deposited their instruments of acceptance thereof. Amendments shall enter into force for any Party which has accepted them after two-thirds of the Parties have deposited their instruments of acceptance of the amendment, on the ninetieth day after the date on which that Party deposited its instrument of acceptance of the amendments.

4. Amendments to the Technical Annex shall be adopted by consensus of the Parties present at a meeting of the Executive Body and shall become effective thirty days after the date on which they have been communicated in accordance with paragraph 5 below.

5. Amendments under paragraphs 3 and 4 above shall, as soon as possible after their adoption, be communicated by the Executive Secretary to all Parties.

Article 12

Settlement of disputes

If a dispute arises between two or more Parties as to the interpretation or application of the present Protocol, they shall seek a solution by negotiation or by any other method of dispute settlement acceptable to the parties to the dispute.

Article 13

Signature

1. The present Protocol shall be open for signature at Sofia from 1 November 1988 until 4 November 1988 inclusive, then at the Headquarters of the United Nations in New York until 5 May 1989, by the member States of the Commission as well as States having consultative status with the Commission, pursuant to paragraph 8 of Economic and Social Council resolution 36 (IV) of 28 March 1947, and by regional economic integration organizations, constituted by sovereign States members of the Commission, which have competence in respect of the negotiation, conclusion and application of international agreements in matters covered by the Protocol, provided that the States and organizations concerned are Parties to the Convention.

2. In matters within their competence, such regional economic integration organizations shall, on their own behalf, exercise the rights and fulfil the responsibilities which the present Protocol attributes to their member States. In such cases, the member States of these organizations shall not be entitled to exercise such rights individually.

Article 14

Ratification, acceptance, approval and accession

1. The present Protocol shall be subject to ratification, acceptance or approval by Signatories.

2. The present Protocol shall be open for accession as from 6 May 1989 by the States and organizations referred to in article 13, paragraph 1.

3. A State or organization which accedes to the present Protocol after 31 December 1993 may implement articles 2 and 4 no later than 31 December 1995.

4. The instruments of ratification, acceptance, approval or accession shall be deposited with the Secretary-General of the United Nations, who will perform the functions of depositary.

Article 15

Entry into force

1. The present Protocol shall enter into force on the ninetieth day following the date on which the sixteenth instrument of ratification, acceptance, approval or accession has been deposited.

2. For each State and organization referred to in article 13, paragraph 1, which ratifies, accepts or approves the present Protocol or accedes thereto after the deposit of the sixteenth instrument of ratification, acceptance, approval, or accession, the Protocol shall enter into force on the ninetieth day following the date of deposit by such Party of its instrument of ratification, acceptance, approval, or accession.

Article 16

Withdrawal

At any time after five years from the date on which the present Protocol has come into force with respect to a Party, that Party may withdraw from it by giving written notification to the depositary. Any such withdrawal shall take effect on the ninetieth day following the date of its receipt by the depositary, or on such later date as may be specified in the notification of the withdrawal.

Article II

Authentic texts

The original of the present Protocol, of which the English, French and Russian texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

IN WITNESS WHEREOF the undersigned, being duly authorized thereto, have signed the present Protocol.

DONE at Sofia this thirty-first day of October one thousand nine hundred and eighty-eight.

TECHNICAL ANNEX

1. Information regarding emission performance and costs is based on official documentation of the Executive Body and its subsidiary bodies, in particular documents EB.AIR/WG.3/R.8, R.9 and R.16, and ENV/WP.1/R.86, and Corr.1, as reproduced in chapter 7 of Effects and Control of Transboundary Air Pollution. */ Unless otherwise indicated, the technologies listed are considered to be well established on the basis of operational experience. **/

2. The information contained in this annex is incomplete. Because experience with new engines and new plants incorporating low emission technology, as well as with retrofitting existing plants, is continuously expanding, regular elaboration and amendment of the annex will be necessary. The annex cannot be an exhaustive statement of technical options; its aim is to provide guidance for the Parties in identifying economically feasible technologies for giving effect to the obligations of the Protocol.

I. CONTROL TECHNOLOGIES FOR NO_x EMISSIONS FROM STATIONARY SOURCES

3. Fossil fuel combustion is the main stationary source of anthropogenic NO_x emissions. In addition, some non-combustion processes can contribute relevant NO_x emissions.

4. Major stationary source categories of NO_x emissions may include:

(a) Combustion plants;

(b) Industrial process furnaces (e.g., cement manufacture);

(c) Stationary gas turbines and internal combustion engines; and

(d) Non-combustion processes (e.g., nitric acid production).

5. Technologies for the reduction of NO_x emissions focus on certain combustion/process modifications, and, especially for large power plants, on flue gas treatment.

6. For retrofitting of existing plants, the extent of application of low-NO_x technologies may be limited by negative operational side-effects or by other site-specific constraints. In the case of retrofitting, therefore, only approximate estimates are given for typically achievable NO_x emission values. For new plants, negative side-effects can be minimized or excluded by appropriate design features.

---

*/ Air Pollution Studies No. 4 (United Nations publication, Sales No. E.87.II.E.36).

**/ It is at present difficult to provide reliable data on the costs of control technologies in absolute terms. For cost data included in the present annex, emphasis should therefore be placed on the relationships between the costs of different technologies rather than on absolute cost figures.

7. According to currently available data, the costs of combustion modifications can be considered as small for new plants. However, in the case of retrofitting, for instance at large power plants, they ranged from about 3 to 25 Swiss francs per kW_{el} (in 1985). As a rule, investment costs of flue gas treatment systems are considerably higher.

8. For stationary sources, emission factors are expressed in milligrams of NO_2 per normal (0° C, 1013 mb) cubic metre (mg/m^3), dry basis.

Combustion plants

9. The category of combustion plants comprises fossil fuel combustion in furnaces, boilers, indirect heaters and other combustion facilities with a heat input larger than 10 MW, without mixing the combustion flue gases with other effluents or treated materials. The following combustion technologies, either singly or in combination, are available for new and existing installations:

(a) Low-temperature design of the firebox, including fluidized bed combustion;

(b) Low excess-air operation;

(c) Installation of special low-NO_x burners;

(d) Flue gas recirculation into the combustion air;

(e) Staged combustion/overfire-air operation; and

(f) Reburning (fuel staging). ***/

Performance standards that can be achieved are summarized in table 1.

10. Flue gas treatment by selective catalytic reduction (SCR) is an additional NO_x emission reduction measure with efficiencies of up to 80 per cent and more. Considerable operational experience from new and retrofitted installations is now being obtained within the region of the Commission, in particular for power plants larger than 300 MW (thermal). When combined with combustion modifications, emission values of 200 mg/m^3 (solid fuels, 6% O_2) and 150 mg/m^3 (liquid fuels, 3% O_2) can be easily met.

11. Selective non-catalytic reduction (SNCR), a flue gas treatment for a 20-60% NO_x reduction, is a cheaper technology for special applications (e.g., refinery furnaces and base load gas combustion).

***/ There is limited operational experience of this type of combustion technology.

Table 1: NO_x performance standards (mg/m^3) that can be achieved by combustion modifications

	Plant type a/		Uncontrolled baseline	Existing plant retrofit b/		New plant	O_2 %
				Range	Typical value		
Solid Fuels	10 MW c/ to 300 MW	Grate Combustion (coal)	300 - 1 000	-	600	400	7
		Fluidized Bed Combustion					
		(i) stationary	300 - 600	-	-	400	7
		(ii) circulating	150 - 300	-	-	200	7
		Pulverized Coal Combustion					
		(i) dry bottom	700 - 1 700	600 - 1 100	800	< 600	6
		(ii) wet bottom	1 000 - 2 300	1 000 - 1 400	-	< 1 000	6
	>300 MW	Pulverized Coal Combustion					
		(i) dry bottom	700 - 1 700	600 - 1 100	-	< 600	6
		(ii) wet bottom	1 000 - 2 300	1 000 - 1 400	-	< 1 000	6
Liquid Fuels	10 MW c/ to 300 MW	Distillate Oil Combustion	-	-	300	-	3
		Residual Oil Combustion	500 - 1 400	200 - 400	400	-	3
	>300 MW	Residual Oil Combustion	500 - 1 400	200 - 400	-	-	3
Gaseous Fuels	10 MW c/ to 300 MW		150 - 1 000	100 - 300	-	< 300	3
	>300 MW		250 - 1 400	100 - 300	-	< 300	3

a/ Capacity numbers refer to MW (thermal) heat input by fuel (lower heating value).
b/ Only approximate values can be given due to site specific factors and greater uncertainty for retrofitting of existing plant.
c/ For small (10 MW - 100 MW) plants a greater degree of uncertainty applies to all figures given.

Stationary gas turbines and internal combustion (IC) engines

12. NO_x emissions from stationary gas turbines can be reduced either by combustion modification (dry control) or by water/steam injection (wet control). Both measures are well established. By these means, emission values of 150 mg/m^3 (gas, 15% O_2) and 300 mg/m^3 (oil, 15% O_2) can be met. Retrofit is possible.

13. NO_x emissions from stationary spark ignition IC engines can be reduced either by combustion modifications (e.g., lean-burn and exhaust gas recirculation concepts) or by flue gas treatment (closed-loop 3-way catalytic converter, SCR). The technical and economic feasibility of these various processes depends on engine size, engine type (two stroke/four stroke), and engine operation mode (constant/varying load). The lean-burn concept is capable of meeting NO_x emission values of 800 mg/m^3 (5% O_2), the SCR process reduces NO_x emissions well below 400 mg/m^3 (5% O_2), and the three-way catalytic converter reduces such emissions even below 200 mg/m^3 (5% O_2).

Industrial process furnaces - Cement calcination

14. The precalcination process is being evaluated within the region of the Commission as a possible technology with the potential for reducing NO_x concentrations in the flue gas of new and existing cement calcination furnaces to about 300 mg/m^3 (10% O_2).

Non-combustion processes - Nitric acid production

15. Nitric acid production with a high pressure absorption (>8 bar) is capable of keeping NO_x concentrations in undiluted effluents below 400 mg/m^3. The same emission performance can be met by medium pressure absorption in combination with a SCR process or any other similar efficient NO_x reduction process. Retrofit is possible.

II. CONTROL TECHNOLOGIES FOR NO_x EMISSIONS FROM MOTOR VEHICLES

16. The motor vehicles considered in this annex are those used for road transport, namely: petrol-fuelled and diesel-fuelled passenger cars, light-duty vehicles and heavy-duty vehicles. Appropriate reference is made, as necessary, to the specific vehicle categories (M_1, M_2, M_3, N_1, N_2, N_3) defined in ECE Regulation No. 13 pursuant to the 1958 Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicles Equipment and Parts.

17. Road transport is a major source of anthropogenic NO_x emission in many Commission countries, contributing between 40 and 80 per cent of total national emissions. Typically, petrol-fuelled vehicles contribute two-thirds of total road transport NO_x emissions.

18. The technologies available for the control of nitrogen oxides from motor vehicles are summarized in tables 3 and 6. It is convenient to group the technologies by reference to existing or proposed national and international emission standards differing in stringency of control. Because current regulatory test cycles only reflect urban and metropolitan driving, the estimates of relative NO_x emissions given below take account of higher speed driving where NO_x emissions can be particularly important.

19. The additional production cost figures for the various technologies given in tables 3 and 6 are manufacturing cost estimates rather than retail prices.

20. Control of production conformity and in-use vehicle performance is important in ensuring that the reduction potential of emission standards is achieved in practice.

21. Technologies that incorporate or are based on the use of catalytic converters require unleaded fuel. Free circulation of vehicles equipped with catalytic converters depends on the general availability of unleaded petrol.

Petrol-fuelled and diesel-fuelled passenger cars (M_1)

22. In table 2, four emission standards are summarized. These are used in table 3 to group the various engine technologies for petrol vehicles according to their NO_x emission reduction potential.

Table 2: Definition of emission standards

Standard	Limits	Comments
A. ECE R.15-04	HC + NO_x: 19-29 g/test	Current ECE standard (Regulation No.15, including the 04 series of amendments, pursuant to the 1958 Agreement referred to in paragraph 16 above), also adopted by the European Economic Community (Directive 83/351/EEC). ECE R.15 urban test cycle. Emission limit varies with vehicle mass.
B. "Luxembourg 1985"	HC + NO_x: 1.4-2.0 l : 8.0 g/test This standard only used to group technology (<1.4 l : 15.0 g/test, >2.0 l : 6.5 g/test)	Standards to be introduced during 1988-1993 in the European Economic Community, as discussed at the 1985 Luxembourg meeting of EEC Council of Ministers and finally agreed upon in December 1987. ECE R.15 urban test cycle applies. Standard for engines >2 l is generally equivalent to US 1983 standard. Standard for engines <1.4 l is provisional, definite standard to be elaborated. Standard for engines of 1.4-2.0 applies to all diesel cars >1.4 l.
C. "Stockholm 1985"		Standards for national legislation based on the "master document" developed after the 1985 Stockholm meeting of Environment Ministers from eight countries. Matching US 1987 standards, with the following test procedures:
	NO_x: 0.62 g/km	US Federal Test Procedure (1975).
	NO_x: 0.76 g/km	Highway fuel economy test procedure.
D. "California 1989"	NO_x: 0.25 g/km	Standards to be introduced in the State of California, United States from 1989 models onwards. US Federal Test Procedure.

Table 3: Petrol engine technologies, emission performance, costs and fuel consumption for emission standard levels

Standard	Technology	Composite a/ NO_x reduction (%)	Additional b/ production cost (1986 Swiss francs)	Fuel consumption index a/
A.	Baseline (Current conventional spark-ignition engine with carburettor)	- c/	-	100
B.				
	(a) Fuel injection + EGR + secondary air d/	25	200	105
	(b) Open-loop three-way catalyst (+EGR)	55	150	103
	(c) Lean-burn engine with oxidation catalyst (+EGR) e/	60	200-600	90
C.	Closed-loop three-way catalyst	90	300-600	95
D.	Closed-loop three-way catalyst (+ EGR)	92	350-650	98

a/ Composite NO_x reduction and fuel consumption index estimates are for an average-weight European car operating under average European driving conditions.

b/ Additional production costs could be more realistically expressed as a percentage of the total car cost. However, since cost estimates are primarily for comparison in relative terms only, the formulation of the original documents has been retained.

c/ Composite NO_x emission factor = 2.6 g/km.

d/ "EGR" means exhaust gas recirculation.

e/ Based entirely on data for experimental engines. Virtually no production of lean-burn engined vehicles exists.

23. The emission standards A, B, C and D include limits on hydrocarbon (HC) and carbon monoxide (CO) emissions as well as NO_x. Estimates of emission reductions for these pollutants, relative to the baseline ECE R.15-04 case, are given in table 4.

Table 4: Estimated reductions in HC and CO emissions from petrol-fuelled passenger cars for different technologies

Standard	HC-reduction (%)	CO-reduction (%)
B.	(a) 30-40	50
	(b) 50-60	40-50
	(c) 70-90	70-90
C.	90	90
D.	90	90

24. Current diesel cars can meet the NO_x emission requirements of standards A, B and C. Strict particulate emission requirements, together with the stringent NO_x limits of standard D, imply that diesel passenger cars will require further development, probably including electronic control of the fuel pump, advanced fuel injection systems, exhaust gas recirculation and particulate traps. Only experimental vehicles exist to date. (See also table 6, footnote a/).

Other light-duty vehicles (N_1)

25. The control methods for passenger cars are applicable but NO_x reductions, costs and commercial lead time factors may differ.

Heavy-duty petrol-fuelled vehicles (M_2, M_3, N_2, N_3)

26. This class of vehicle is insignificant in western Europe and is decreasing in eastern Europe. US 1990 and US 1991 NO_x emission levels (see table 5) could be achieved at modest cost without significant technology advancement.

Heavy-duty diesel-fuelled vehicles (M_2, M_3, N_2, N_3)

27. In table 5, three emission standards are summarized. These are used in table 6 to group engine technologies for heavy-duty diesel vehicles according to NO_x reduction potential. The baseline engine configuration is changing, with a trend away from naturally aspirated to turbo-charged engines. This trend has implications for improved baseline fuel consumption performance. Comparative estimates of consumption are therefore not included.

Table 5: Definition of emission standards

Standard	NO_x limits (g/kWh)	Comments
I ECE R.49	18	13 mode test
II US-1990	8.0	Transient test
III US-1991	6.7	Transient test

Table 6: Heavy-duty diesel engine technologies, emission performance, a/ and costs for emission standard levels

Standard	Technology	NO_x reduction estimate (%)	Additional production cost (1984 US$)
I	Current conventional direct injection diesel engine	-	-
II b/	Turbo-charging + after-cooling + injection timing retard (Combustion chamber and port modification) (Naturally-aspirated engines are unlikely to meet this standard)	40	$115 ($69 attributable to NO_x standard) c/
III b/	Further refinements of technologies listed under II together with variable injection timing and use of electronics	50	$404 ($68 attributable to NO_x standard) c/

a/ Deterioration in diesel fuel quality would adversely affect emission and may affect fuel consumption for both heavy and light duty vehicles.

b/ It is still necessary to verify on a large scale the availability of new components.

c/ Particulate control and other considerations account for the balance.

ISSN 0254-1475

COM(91) 268 final

DOCUMENTS

EN 14

Catalogue number : CB-CO-91-309-EN-C

ISBN 92-77-74225-9

Office for Official Publications of the European Communities
L-2985 Luxembourg