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Legislation

Contents

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other Acts are printed in bold type and preceded by an asterisk.

II

(Acts whose publication is not obligatory)

COUNCIL

COUNCIL DIRECTIVE

of 12 December 1991

concerning the protection of waters against pollution caused by nitrates from agricultural sources

(91/676/EEC)

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 (1),

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas the nitrate content of water in some areas of Member States is increasing and is already high as compared with standards laid down in Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (4), as amended by Directive 79/869/EEC (5), and Council Directive 80/778/EEC of 15 July 1980 relating to the quality of water intended for human consumption (6), as amended by the 1985 Act of Accession;

Whereas the fourth programme of action of the European Economic Communities on the environment (7) indicated that the Commission intended to make a proposal for a Directive on the control and reduction of water pollution resulting from the spreading or discharge of livestock effluents and the excessive use of fertilizers;

Whereas the reform of the common agricultural policy set out in the Commission's green paper 'Perspectives for the common agricultural policy' indicated that, while the use of nitrogen-containing fertilizers and manures is necessary for Community agriculture, excessive use of fertilizers constitutes an environmental risk, that common action is needed to control the problem arising from intensive livestock production and that agricultural policy must take greater account of environmental policy;

Whereas the Council resolution of 28 June 1988 of the protection of the North Sea and of other waters in the Community (8) invites the Commission to submit proposals for measures at Community level;

Whereas the main cause of pollution from diffuse sources affecting the Community's waters in nitrates from agricultural sources;

(1) OJ No C 54, 3. 3. 1989, p. 4 and OJ No C 51, 2. 3. 1990, p. 12.
(2) OJ No C 158, 26. 6. 1989, p. 487.
(3) OJ No C 159, 26. 6. 1989, p. 1.
(4) OJ No L 194, 25. 7. 1975, p. 26.
(5) OJ No L 271, 29. 10. 1979, p. 44.
(6) OJ No L 229, 30. 8. 1980, p. 11.
(7) OJ No C 328, 7. 12. 1987, p. 1.
(8) OJ No C 209, 9. 8. 1988, p. 3.

Whereas it is therefore necessary, in order to protect human health and living resources and aquatic ecosystems and to safeguard other legitimate uses of water, to reduce water pollution caused or induced by nitrates from agricultural sources and to prevent further such pollution; whereas for this purpose it is important to take measures concerning the storage and the application on land of all nitrogen compounds and concerning certain land management practices;

Whereas since pollution of water due to nitrates on one Member State can influence waters in other Member States, action at Community level in accordance with Article 130r is therefore necessary;

Whereas, by encouraging good agricultural practices, Member States can provide all waters with a general level of protection against pollution in the future;

Whereas certain zones, draining into waters vulnerable to pollution from nitrogen compounds, require special protection;

Whereas it is necessary for Member States to identify vulnerable zones and to establish and implement action programmes in order to reduce water pollution from nitrogen compounds in vulnerable zones;

Whereas such action programmes should include measures to limit the land-application of all nitrogen-containing fertilizers and in particular to set specific limits for the application of livestock manure;

Whereas it is necessary to monitor waters and to apply reference methods of measurement for nitrogen compounds to ensure that measures are effective;

Whereas it is recognized that the hydrogeology in certain Member States is such that it may be many years before protection measures lead to improvements in water quality;

Whereas a Committee should be established to assist the Commission on matters relating to the implementation of this Directive and to its adaptation to scientific and technical progress;

Whereas Member States should establish and present to the Commission reports on the implementation of this Directive;

Whereas the Commission should report regularly on the implementation of this Directive by the Member States,

HAS ADOPTED THIS DIRECTIVE:

Article 1

This Directive has the objective of:

— reducing water pollution caused or induced by nitrates from agricultural sources and

— preventing further such pollution.

Article 2

For the purpose of this Directive:

(a) 'groundwater': means all water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil;

(b) 'freshwater': means naturally occurring water having a low concentration of salts, which is often acceptable as suitable for abstraction and treatment to produce drinking water;

(c) 'nitrogen compound': means any nitrogen-containing substance except for gaseous molecular nitrogen;

(d) 'livestock': means all animals kept for use or profit;

(e) 'fertilizer': means any substance containing a nitrogen compound or nitrogen compounds utilized on land to enhance growth of vegetation; it may include livestock manure, the residues from fish farms and sewage sludge;

(f) 'chemical fertilizer': means any fertilizer which is manufactured by an industrial process;

(g) 'livestock manure': means waste products excreted by livestock or a mixture of litter and waste products excreted by livestock, even in processed form;

(h) 'land application': means the addition of materials to land whether by spreading on the surface of the land, injection into the land, placing below the surface of the land or mixing with the surface layers of the land;

(i) 'eutrophication': means the enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned;

(j) 'pollution': means the discharge, directly or indirectly, of nitrogen compounds from agricultural sources into the aquatic environment, the results of which are such as to cause hazards to human health, harm to living resources and to aquatic ecosystems, damage to amenities or interference with other legitimate uses of water;

(k) 'vulnerable zone': means an area of land designated according to Article 3 (2).

Article 3

1. Waters affected by pollution and waters which could be affected by pollution if action pursuant Article 5 is not taken shall be identified by the Member States in accordance with the criteria set out in Annex I.

2. Member States shall, within a two-year period following the notification of this Directive, designate as vulnerable zones all known areas of land in their territories which drain into the waters identified according to paragraph 1 and which contribute to pollution. They shall notify the Commission of this initial designation within six months.

3. When any waters identified by a Member State in accordance with paragraph 1 are affected by pollution from waters from another Member State draining directly or indirectly in to them, the Member States whose waters are affected may notify the other Member States and the Commission of the relevant facts.

The Member States concerned shall organize, where appropriate with the Commission, the concertation necessary to identify the sources in question and the measures to be taken to protect the waters that are affected in order to ensure conformity with this Directive.

4. Member States shall review if necessary revise or add to the designation of vulnerable zones as appropriate, and at last every four years, to take into account changes and factors unforeseen at the time of the previous designation. They shall notify the Commission of any revision or addition to the designations within six months.

5. Member States shall be exempt from the obligation to identify specific vulnerable zones, if they establish and apply action programmes referred to in Article 5 in accordance with this Directive throughout their national territory.

Article 4

1. With the aim of providing for all waters a general level of protection against pollution, Member States shall, within a two-year period following the notification of this Directive:

(a) establish a code or codes of good agricultural practice, to be implemented by farmers on a voluntary basis, which should contain provisions covering at least the items mentioned in Annex II A;

(b) set up where necessary a programme, including the provision of training and information for farmers, promoting the application of the code(s) of good agricultural practice.

2. Member States shall submit to the Commission details of their codes of good agricultural practice and the Commission shall include information on these codes in the report referred to in Article 11. In the light of the information received, the Commission may, if it considers it necessary, make appropriate proposals to the Council.

Article 5

1. Within a two-year period following the initial designation referred to in Article 3 (2) or within one year of each additional designation referred to in Article 3 (4), Member States shall, for the purpose of realizing the objectives specified in Article 1, establish action programmes in respect of designated vulnerable zones.

2. An action programme may relate to all vulnerable zones in the territory of a Member State or, where the Member State considers it appropriate, different programmes may be established for different vulnerable zones or parts of zones.

3. Action programmes shall take into account:

(a) available scientific and technical data, mainly with reference to respective nitrogen contributions originating from agricultural and other sources;

(b) environmental conditions in the relevant regions of the Member State concerned.

4. Action programmes shall be implemented within four years of their establishment and shall consist of the following mandatory measures:

(a) the measures in Annex III;

(b) those measures which Member States have prescribed in the code(s) of good agricultural practice established in accordance with Article 4, except those which have been superseded by the measures in Annex III.

5. Member States shall moreover take, in the framework of the action programmes, such additional measures or reinforced actions as they consider necessary if, at the outset or in the light of experience gained in implementing the action programmes, it becomes apparent that the measures referred to in paragraph 4 will not be sufficient for achieving the objectives specified in Article 1. In selecting these measures or actions, Member States shall take into account their effectiveness and their cost relative to other possible preventive measures.

6. Member States shall draw up and implement suitable monitoring programmes to assess the effectiveness of action programmes established pursuant to this Article.

Member States which apply Article 5 throughout their national territory shall monitor the nitrate content of waters (surface waters and groundwater) at selected measuring points which make it possible to establish the extent of nitrate pollution in the waters from agricultural sources.

7. Member States shall review and if necessary revise their action programmes, including any additional measures taken pursuant to paragraph 5, at least every four years. They shall inform the Commission of any changes to the action programmes.

Article 6

1. For the purpose of designating and revising the designation of vulnerable zones, Member States shall:

(a) within two years of notification of the Directive, monitor the nitrate concentration in freshwaters over a period of one year:

(i) at surface water sampling stations, laid down in Article 5 (4) of Directive 75/440/EEC and/or at other sampling stations which are representative of surface waters of Member States, at least monthly and more frequently during flood periods;

(ii) at sampling stations which are representative of the groundwater aquifers of Member States, at regular intervals and taking into account the provisions of Directive 80/778/EEC;

(b) repeat the monitoring programme outlined in (a) at least every four years, except for those sampling stations where the nitrate concentration in all previous samples has been below 25 mg/l and no new factor likely to increase the nitrage content has appeared, in which case the monitoring programme need be repeated only every eight years;

(c) review the eutrophic state of their fresh surface waters, estuarial and coastal waters every four years.

2. The reference methods of measurement set out in Annex IV shall be used.

Article 7

Guidelines for the monitoring referred to in Article 5 and 6 may be drawn up in accordance with the procedure laid down in Article 9.

Article 8

The Annexes to this Directive may be adapted to scientific and technical progress in accordance with the procedure laid down in Article 9.

Article 9

1. The Commission shall be assisted by a Committee composed of the representative of the Member States and chaired by the representative of the Commission.

2. The representative of the Commission shall submit to the Commission a draft of the measures to be taken. The Committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 148 (2) of the EEC Treaty in the case of decisions which the Council is required to adopt a proposal from the Commission. The votes of the representatives of the Member States within the Committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

3. (a) The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the Committee.

(b) If the measures envisaged are not in accordance with the opinion of the Committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

(c) If, on the expiry of a period of three months from the date of referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission, save where the Council has decided against the said measures by a simple majority.

Article 10

1. Member States shall, in respect of the four-year period following the notification of this Directive and in respect of each subsequent four-year period, submit a report to the Commission containing the information outlined in Annex V.

2. A report pursuant to this Article shall be submitted to the Commission within six months of the end of the period to which it relates.

Article 11

On the basis of the information received pursuant to Article 10, the Commission shall publish summary reports within six months of receiving the reports from Member States and shall communicate them to the European Parliament and to the Council. In the light of the implementation of the Directive, and in particular the provisions of Annex III, the Commission shall submit to the Council by 1 January 1998 a report accompanied where appropriate by proposals for revision of this Directive.

Article 12

1. The Member States shall bring into force the laws, regulations and administrative provisions necessary to

comply with this Directive within two years of its notification (1). They shall forthwith inform the Commission thereof.

2. When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such a reference shall be laid down by the Member States.

3. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the field governed by this Directive.

Article 13

This Directive is addressed to the Member States.

Done at Brussels, 12 December 1991.

For the Council

The President

J.G.M. ALDERS

(1) This Directive was notified to the Member States on 19 December 1991.

ANNEX I

CRITERIA FOR IDENTIFYING WATERS REFERRED TO IN ARTICLE 3 (1)

A. Waters referred to in Article 3 (1) shall be identified making use, *inter alia,* of the following criteria:

1. whether surface freshwaters, in particular those used or intended for the abstraction of drinking water, contain or could contain, if action pursuant to Article 5 is not taken, more than the concentration of nitrates laid down in accordance with Directive 75/440/EEC;
2. whether groundwaters contain more than 50 mg/l nitrates or could contain more than 50 mg/l nitrates if action pursuant to Article 5 is not taken;
3. whether natural freshwater lakes, other freshwater bodies, estuaries, coastal waters and marine waters are found to be eutrophic or in the near future may become euthropic if action pursuant to Article 5 is not taken.

B. In applying these criteria, Member States shall also take account of:

1. the pyhsical and environmental characteristics of the waters and land;
2. the current understanding of the behaviour of nitrogen compounds in the environment (water and soil);
3. the current understanding of the impact of the action taken pursuant to Article 5.

ANNEX II

CODE(S) OF GOOD AGRICULTURAL PRACTICE

A. A code or codes of good agricultural practice with the objective of reducing pollution by nitrates and taking account of conditions in the different regions of the Community should certain provisions covering the following items, in so far as they are relevant:

1. periods when the land application of fertilizer is inappropriate;
2. the land application of fertilizer to steeply sloping ground;
3. the land application of fertilizer to water-saturated, flooded, frozen or snow-covered ground;
4. the conditions for land application of fertilizer near water courses;
5. the capacity and construction of storage vessels for livestock manures, including measures to prevent water pollution by run-off and seepage into the groundwater and surface water of liquids containing livestock manures and effluents from stored plant materials such as silage;
6. procedures for the land application, including rate and uniformity of spreading, of both chemical fertilizer and livestock manure, that will maintain nutrient losses to water at an acceptable level.

B. Member States may also include in their code(s) of good agricultural practices the following items:

7. land use management, including the use of crop rotation systems and the proportion of the land area devoted to permanent crops relative to annual tillage crops;
8. the maintenance of a minimum quantity of vegetation cover during (rainy) periods that will take up the nitrogen from the soil that could otherwise cause nitrate pollution of water;
9. the establishment of fertilizer plans on a farm-by-farm basis and the keeping of records on fertilizer use;
10. the prevention of water pollution from run-off and the downward water movement beyond the reach of crop roots in irrigation systems.

ANNEX III

MEASURES TO BE INCLUDED IN ACTION PROGRAMMES AS REFERRED TO IN ARTICLE 5 (4) (a)

1. The measures shall include rules relating to:

   1. periods when the land application of certain types of fertilizer is prohibited;

   2. the capacity of storage vessels for livestock manure; this capacity must exceed that required for storage throughout the longest period during which land application in the vulnerable zone is prohibited, except where it can be demonstrated to the competent authority that any quantity of manure in excess of the actual storage capacity will be disposed of in a manner which will not cause harm to the environment;

   3. limitation of the land application of fertilizers, consistent with good agricultural practice and taking into account the characteristics of the vulnerable zone concerned, in particular:

      (a) soil conditions, soil type and slope;

      (b) climatic conditions, rainfall and irrigation;

      (c) land use and agricultural practices, including crop rotation systems;

      and to be based on a balance between:

      (i) the foreseeable nitrogen requirements of the crops,
      and

      (ii) the nitrogen supply to the crops from the soil and from fertilization corresponding to:
      - the amount of nitrogen present in the soil at the moment when the crop starts to use it to a significant degree (outstanding amounts at the end of winter),
      - the supply of nitrogen through the net mineralization of the reserves of organic nitrogen in the soil,
      - additions of nitrogen compounds from livestock manure,
      - additions of nitrogen compounds from chemical and other fertilizers.

2. These measures will ensure that, for each farm or livestock unit, the amount of livestock manure applied to the land each year, including by the animals themselves, shall not exceed a specified amount per hectare.

   The specified amount per hectare be the amount of manure containing 170 kg N. However:

   (a) for the first four year action programme Member States may allow an amount of manure containing up to 210 kg N;

   (b) during and after the first four-year action programme, Member States may fix different amounts from those referred to above. These amounts must be fixed so as not to prejudice the achievement of the objectives specified in Article 1 and must be justified on the basis of objectives criteria, for example:
   - long growing seasons,
   - crops with high nitrogen uptake,
   - high net precipitation in the vulnerable zone,
   - soils with exceptionally high denitrification capacity.

   If a Member State allows a different amount under subparagraph (b), it shall inform the Commission which will examine the justification in accordance with the procedure laid down in Article 9.

3. Member States may calculate the amounts referred to in paragraph 2 on the basis of animal numbers.

4. Member States shall inform the Commission of the manner in which they are applying the provisions of paragraph 2. In the light of the information received, the Commission may, if it considers necessary, make appropriate proposals to the Council in accordance with Article 11.

ANNEX IV

REFERENCE METHODS OF MEASUREMENT

Chemical fertilizer

Nitrogen compounds shall be measured using the method described in Commission Directive 77/535/EEC of 22 June 1977 on the approximation of the laws of the Member States relating to methods of sampling and analysis for fertilizers (1), as amended by Directive 89/519/EEC (2).

Freshwaters, coastal waters and marine waters

Nitrate concentration shall be measured in accordance with Article 4a (3) of Council Decision 77/795/EEC of 12 December 1977 establishing a common procedure for the exchange of information on the quality of surface fresh water in the Community (3), as amended by Decision 86/574/EEC (4).

ANNEX V

INFORMATION TO BE CONTAINED IN REPORTS TO IN ARTICLE 10

1. A statement of the preventive action taken pursuant to Article 4.

2. A map showing the following:

   (a) waters identified in accordance with Article 3 (1) and Annex I indicating for each water which of the criteria in Annex I was used for the purpose of identification;

   (b) the location of the designed vulnerable zones, distinguishing between existing zones and zones designated since the previous report.

3. A summary of the monitoring results obtained pursuant to Article 6, including a statement of the considerations which led to the designation of each vulnerable zone and to any revision of or addition to designations of vulnerable zones.

4. A summary of the action programmes drawn up pursuant to Article 5 and, in particular:

   (a) the measures required by Article 5 (4) (a) and (b);

   (b) the information required by Annex III (4);

   (c) any additional measures or reinforced actions taken pursuant to Article 5 (5);

   (d) a summary of the results of the monitoring programmes implemented pursuant to Article 5 (6);

   (e) the assumptions made by the Member States about the likely timescale within which the waters identified in accordance with Article 3 (1) are expected to respond to the measure in the action programme, along with an indication of the level of uncertainty incorporated in these assumptions.

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(1) OJ No L 213, 22. 8. 1977, p. 1.
(2) OJ No L 265, 12. 9. 1989, p. 30.
(3) OJ No L 334, 24. 12. 1977, p. 29.
(4) OJ No L 335, 28. 11. 1986, p. 44.

COUNCIL DECISION

of 19 December 1991

approving amendments to the Statutes of the Joint European Torus (JET), Joint Undertaking,

(91/677/Euratom)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 50 thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas, for the purpose, of implementing the JET Project, the Council, by Decision 78/471/Euratom (4), established the Joint European Torus (JET), Joint Undertaking, and adopted the Statutes thereof, as last amended by Decision 88/447/Euratom (5);

Whereas, both to achieve fully the aims of the JET Project as defined in Decision 78/471/Euratom and to establish reliable methods of impurity control of a plasma before proceeding to the construction of a Next-Step fusion device, it is necessary to introduce a new phase into the JET programme, the objective of when would be to establish the effective control of impurities in operation conditions close to those of the Next Step;

Whereas, by its Decision 90/221/Euratom, EEC (6), the Council adopted a third Framework Programme of Community activities in the field of research and technological development (1990-1994), specifying *inter alia,* the possible extension of the JET Joint Undertaking; whereas this Decision should be taken in the light of the grounds set out in the preamble to that Decision;

Whereas the Commission has arranged for the evaluation and appraisal provided for in Article 3 of Council Decision 88/448/Euratom, EEC of 25 July 1988 adopting a multiannual research and training programme in the field of controlled thermonuclear fusion (7) and is submitting this proposal on the basis of that evaluation and appraisal;

Whereas, the JET Council has, for that purpose, approved an extension of the Joint Undertaking to 31 December 1996 and the corresponding amendments to the JET Statutes;

Whereas, the 'Swedish Natural Science Research Council' replaces the 'Swedish Energy Research Commission' as the Swedish Member of the Joint Undertaking from 1 July 1987;

Whereas, the 'Kernforschunsanlage Jülich GmbH' changed its name to 'Forschungszentrum Jülich GmbH' on 1 January 1990;

Whereas the 'Comitato nazionale per la ricerca e per lo sviluppo dell'energia nucleare e dell'energie alternative (ENEA)' changed its name to 'Ente per le nuove tecnologie, l'energia e l'ambiente (ENEA)' on 14 September 1991,

HAS DECIDED AS FOLLOWS:

Article 1

The amendments to the Statutes of the 'Joint European Torus (JET), Joint Undertaking', annexed to this Decision, are hereby approved.

Article 2

This Decision shall enter into force on the day following that of its publication in the *Official Journal of the European Communities*.

Done at Brussels, 19 December 1991.

For the Council

The President

P. DANKERT

(1) OJ No C 261, 16. 10. 1990, p. 8.
(2) Opinion delivered on 10 December 1991 (not yet published in the Official Journal).
(3) OJ No C 120, 6. 5. 1991, p. 1.
(4) OJ No L 151, 7. 6. 1978, p. 10.
(5) OJ No L 222, 12. 8. 1988, p. 4.
(6) OJ No L 177, 8. 5. 1990, p. 28.
(7) OJ No L 222, 12. 8. 1988, p. 5.

ANNEX

1. Article 1.3 of the Statutes of the Joint European Torus (JET), Joint Undertaking shall be replaced by the following:

'1.3 The Joint Undertaking shall have the following Members:

— the European Atomic Energy Community (herinafter referred to as 'Euratom'),

— the Belgian State (hereinafter referred to as 'Belgium'), acting for its own part ('Laboratoire de physique des plasmas de l'Ecole Royale Militaire — Laboratorium voor plasmaphysica van de Koninklijke Militaire School') and on behalf of the 'Université libre de Bruxelles' ('Service de physique statistique, plasmas et optique non-linéaire de l'ULB') und des 'Centre d'Etude de l'Energie Nucléaire' (CEN)/'Studiecentrum voor Kernenergie' (SCK),

— the 'Centro de Investigaciones Energéticas Medioambientales y Tecnológicas', Spanien (hereinafter referred to as 'Ciemat'),

— das 'Commissariat à l'Energie Atomique', France (herinafter referred to as 'CEA'),

— the 'Ente per le Nuova Tecnologie, l'Energia e l'Ambiente' (herinafter referred to as 'ENEA' which, since 1 Januare 1986, has represented all Italian activities falling within the Euratom Fusion programme, including that of the 'Consiglio Nazionale delle Ricerche', CNR),

— the Hellenic Republic (hereinafter referred to as 'Greece'),

— the 'Forschungszentrum Jülich GmbH', Federal Republic of Germany (herinafter referred to as 'KFA' and which, until 1 January 1990, was known as 'Kernforschungsanlage Jülich GmbH'),

— the 'Forskningscenter Risoe', Denmark (hereinafter referred to as 'Risoe'),

— the Grand Duchy of Luxembourg (hereinafter referred to as 'Luxembourg'),

— the 'Junta Nacional de Investigaçao Cientifica e Tecnologica', Portugal (hereinafter referred to as 'JNICT'),

— Ireland,

— the 'Max-Planck-Gesellschaft zur Förderung der Wissenschaften eV — Institut für Plasmaphysik', Federal Republic of Germany (herinafter referred to as 'IPP'),

— the 'Swedish Natural Science Research Council' (hereinafter referred to as 'NFR' which succeeded the 'Swedish Energy Research Commission' on 1 July 1987, and which, in turn, succeeded the 'National Swedish Board of Energy Source Development' on 1 July 1982),

— the Swiss Confederation (hereinafter referred to as 'Switzerland'),

— the 'Stichting voor Fundamenteel Onderzoek der Materie', Niederlande (herinafter referred to as 'FOM'),

— the 'United Kingdom Atomic Energy Authority' (herinafter referred to as 'the Authority' or 'the Host Organization').'

2. In Article 4.1.1, the reference to 'SERC' shall be replaced by 'NFR'

3. Article 19.1 of the Statutes of the Joint European Torus (JET), Joint Undertaking shall be replaced by the following:

'19.1 The Joint Undertaking shall be established for a period until 31 December 1996.'

COUNCIL DECISION

of 19 December 1991

adopting a research and training programme in the field of controlled thermonuclear fusion (1990 to 1994)

(91/678/Euratom)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,

Having regard to the proposal from the Commission (1), which has consulted the Scientific and Technical Committee,

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas, by Decision 90/221/Euratom, EEC (4), the Council adopted a third Framework Programme of Community activities in the field of research and technological development (1990 to 1994), specifying *inter alia* the research activities to be pursued in the area of controlled thermonuclear fusion; whereas this Decision should be taken as appropriate in the light of the grounds set out in the preamble to that Decision;

Whereas for activities covered by the EAEC Treaty, Article 2 of Decision 90/221/Euratom, EEC provides for the implementation of the third Framework Programme through specific programmes adopted in accordance with Article 7 of the said Treaty;

Whereas the Commission has arranged for the evaluation and appraisal provided for in Article 3 of Council Decision 88/448/Euratom of 25 July 1988 adopting a multiannual research and training programme in the field of controlled thermonuclear fusion (5) and is submitting this proposal on the basis of that evaluation and appraisal;

Whereas the the Joint Research Centre will contribute through its own programme to the implementation of the aforesaid activities;

Whereas basic research in the field of controlled thermonuclear fusion must be encouraged throughout the Community;

Whereas, in addition to the specific programme concerning human resources and mobility, it might be necessary to encourage the training of research workers and engineers in the context of this programme;

Whereas, in the context of this programme, it is desirable that an assessment be made of the economic and social impact as well as of any technological risks;

Whereas, pursuant to Article 4 and Annex I of Decision 90/221/Euratom, EEC the amount deemed necessary for the whole Framework Programme includes an amount of ECU 57 million for the centralized dissemination and exploitation of the results to be divided up in proportion to the amount envisaged for each individual programme;

Whereas the implementation of the European Torus (JET) project has been entrusted to the 'Joint European Torus (JET), Joint Undertaking', established by Decision 78/471/Euratom (6), as last amended by Decision 91/677/Euratom (7);

Whereas the programme embraces all work carried out in the Member States in the field of controlled thermonuclear fusion by magnetic confinement; whereas the execution of this programme must involve the selection of research and development projects to enable them to benefit from Community participation;

Whereas the project to be carried out under the programme must be selected with special attention to the principle of economic and social cohesion in the Community, the transnational nature of the projects and the support to be given to small and medium-sized enterprises;

Whereas the Community's activities aimed at strengthening the scientific and technological basis of European industry and encouraging it to become more competitive include promoting cooperation on research and technological development with third countries and international organizations; whereas such cooperation may prove particularly beneficial to the development of this programme;

(1) OJ No C 261, 16. 10. 1990, p. 8.
(2) Opinion delivered on 10 December 1991 (not yet published in the Official Journal).
(3) OJ No C 120, 6. 5. 1991, p. 1.
(4) OJ No L 117, 8. 5. 1990, p. 28.
(5) OJ No L 222, 12. 8. 1988, p. 5.
(6) OJ No L 151, 7. 6. 1978, p. 10.
(7) See page 9 of this Official Journal.

Whereas, pursuant to Article 101 of the EAEC Treaty the Community has concluded Cooperation Agreements in the field of controlled thermonuclear fusion and plasma physics with the Kingdom of Sweden and with the Swiss Confederation; whereas the Community has entered into an Agreement of Participation in the International thermonuclear experimental reactor (ITER) conceptual design activities, together with Japan, the Union of Soviet Socialist Republics and the United States of America and is negotiating an Agreement of Participation in the International thermonuclear experimental reactor (ITER) engineering design activities together with the same countries; whereas the Community has entered into a Memorandum of Understanding with the Government of Canada on the involvement of Canada in the European contribution to the ITER conceptual design activities;

Whereas it is necessary, as Annex II to the Decision 90/221/Euratom, EEC provides, to conduct in the Community a fusion programme whose long-term objective is the joint creation of safe, environmentally sound prototype reactors,

HAS ADOPTED THIS DECISION:

Article 1

A research and training programme for the European Atomic Energy Community in the field of controlled thermonuclear fusion, as defined in Annex I, is hereby adopted for a period running from 19 December 1991 to 31 December 1994.

Article 2

1. The Community funds estimated as necessary for the execution of the programme amount to ECU 411,84 million, including expenditure on staff and administration amounting to ECU 77 million.

2. An indicative allocation of funds is set out in Annex II.

3. Should the Council take a Decision in implementation of Article 1 (4) of Decision 90/221/Euratom, EEC, this Decision shall be adapted to take account of the abovementioned Decision.

Article 3

Detailed rules for the implementation of the programme and the amount of the Community's financial contribution are set out in Annex III.

Article 4

1. In the course of the second year of implementation of the programme, the Commission shall review it and transmit a report on the results of the review to the European Parliament, the Council and the Economic and Social Committee, together with proposals for any necessary changes.

2. At the end of the programme, an evaluation of the results achieved shall be conducted for the Commission by a group of independent experts. This group's report, together with any comments by the Commission, shall be transmitted to the European Parliament, the Council and the Economic and Social Committee.

3. The reports referred to in paragraphs 1 and 2 shall be drawn up having regard to the objectives set out in Annex I to this Decision and in accordance with Article 2 (4) of Decision 90/221/Euratom, EEC.

Article 5

For the implementation of the programme, the Commission shall be assisted by the Consultative Committee for the Fusion Programme set up by Council Decision of 16 December 1980.

Article 6

The Commission is authorized to negotiate, in accordance with the second paragraph of Article 101 of the EAEC Treaty, international agreements with third countries members of COST, in particular member countries of the European Free Trade Association (EFTA) and central and eastern European countries, with a view to associating them with the whole or part of the programme.

Article 7

This Decision is addressed to the Member States.

Done at Brussels, 19 December 1991.

For the Council

The President

P. DANKERT

ANNEX I

Scientific and technical objectives and content

This programme fully reflects the approach embodied in the third framework programme in terms of the scientific and technical goals and the underlying aims which it pursues.

Paragraph 5C of Annex II to Decision 90/221/Euratom, EEC containing the framework programme forms an integral part of the present programme.

The scientific and technical objectives and content of this programme are in line with the recommendations of the Fusion Programme Evaluation Board (EUR 13104/1990).

The long-term objective of the Community Fusion Programme, embracing all activities undertaken in the Member States in the field of controlled thermonuclear fusion by magnetic confinement, is the joint creation of safe, environmentally sound prototype reactors referred to in Decision 90/221/Euratom, EEC. A step by step strategy towards the prototype commercial reactor is envisaged, including after JET, an experimental reactor (Next Step) and a demonstration reactor (DEMO).

The first priority objective of the Fusion Programme (1990 to 1994) is to provide the scientific and technological base, to establish environmental and safety criteria and to prepare indusry for the construction of a Next-Step device. The major physics goal of the Next Step will be the achievement of self-sustained thermonuclear burn of a deuterium-tritium plasma and its control during long pulse operation. The Next-Step should demonstrate the safe operation of a device that integrates important technologies of a fusion reactor, and should test components and subsystems essential for a fusion reactor. The Next Step should provide the basic data for the engineering of a demonstration fusion reactor (DEMO) capable of producing significant amounts of electricity while taking due account of environmental constraints.

Other objectives of the specific programme are:

— to protect along the demonstration of the safety and environmental feasibility of fusion power in parallel with the demonstration of its scientific and technological feasibility,

— to enlarge the involvement of European industry, with the view of both injecting industrial expertise into the realization of the Next Step and ensuring that Europe will master all the technologies which will be required for the construction of future fusion reactors,

— to determine the reactor potential of toroidal magnetic configurations akin to the tokamak, concentrating on stellarators and reversed field pinches,

— to maintain a watching brief on other approaches to controlled fusion,

— to strengthen the links between the Association and the rest of the European scientific community, in particular with universities and similar institutions,

— to make available to the Community, if possible in the framework of an international agreement, the powerful source of neutrons necessary for the experiments,

— to widen current knowledge and techniques regarding the treatment of waste and tritium, the first wall, the effects on humans of powerful magnetic fields and scientific and technical alternatives to be implemented within the Fusion Programme.

In order to fulfil the first priority objective of the specific programme, a large fraction of the 1990 to 1994 activities, including those performed on JET and within the Associations, will be in support of the Next Step. Balanced efforts and coherent planning will be ensured the Next-Step design activities, supporting research and development in physics and technology, and industrial involvement.

The following presents an analytical description of the content of the programme, based on and taking account of the above elements as well as of the independent evaluation of the programme and of the appraisal of the environmental, safety-related and economic potential of fusion, performed in 1990 in accordance with Decision 88/448/Euratom.

AREA 1: NEXT-STEP DESIGN

Next Step conceptual design activities are reaching completion in the European framework, NET (Next European Torus), and also in the framework of a quadripartite international collaboration, ITER (International thermonuclear experimental reactor), between the Community, Japan, the Soviet Union and the United States of America. The engineering design of a Next Step device will be undertaken in accordance with the following guidelines:

— the quadripartite approach of ITER will be preferred for technical and economic reasons and the Community's current position of pre-eminence in large tokamaks, acquired especially through JET, will be maintained by a full commitment to the project,

— efforts will be made towards a convergence of the NET and ITER designs,

— a possible broadening of the scope of the ITER collaboration will be investigated with a view to sharing among the partners the main facilities in fusion reactor development. Experience of international cooperation gained in the framework of ITER will be assessed by the Commission for which purpose it will request that a corresponding report be drawn up for the benefit of other possible international cooperation projects,

— the Commission Fusion Programme will retain the capability to proceed with NET if the ITER cooperation proves too difficult to continue.

The engineering design of a Next Step will be started as soon as the framework within which it will be undertaken is agreed. In the proposed case of ITER, the fall back capability of designing a NET, still able to study ignition and long burn in reactor relevant conditions, will be preserved.

Next Step-related physics R&D actions will be undertaken on JET and on the specialized devices in the Associations (see Areas 3 and 4).

Actions in fusion technology, specific to the Next Step, in particular in the fields of superconducting magnets, plasma-facing components, operational and environmental safety, fuel cycle, remote-handling maintenance and decommissioning of the device, will be performed in the Associations, in the Joint Research Centre (JRC), and in industry. The specific actions will be made consistent with the Community commitment to the ITER engineering design activities. The actions aiming at preserving the fall-back capability of the Community to construct a Next Step on its own and involving a substantial financial commitment will be considered in the frame of the next Framework Programme.

The construction of the Next Step may be proposed during the period of the next Framework Programme, together with the required adjustments in organization, management and industrial policies. In defining these policies, experience gained in other large European projects will be taken into account.

AREA 2: LONGER-TERM TECHNICAL DEVELOPMENTS

Environmental and safety criteria will be essential elements governing the evolution of the Fusion Programme. In particular, work on such issues as the development of low activation materials relevant for a reactor, the development of reactor blanket modules, and a reference design for an electricity-producing fusion reactor will be undertaken in the Associations, in the JRC, and in industry.

Material testing requires a powerful source of high energy neutrons. Concept evaluation and possibly design work will be undertaken in the frame of the present programme. At a preliminary stage, adaptation and use of an existing device might be sought through international collaboration.

The development of DEMO-relevant tritium breeding blanket module will be pursued, in view of subsequent testing in the Next Step. These modules should be relevant for an electricity producing reactor, in particular regarding operating temperature and tritium-breeding ratio.

The reference design for an electricity producing reactor will be based on deuterium-tritium reactions. Consequences of using advanced fuels presenting additional advantages regarding safety and environment will be kept under review. The work on reference design will take into account views on social acceptability of fusion and on the requirements of utilities in operating such a reactor. It will constitute the technical basis for further safety analysis.

AREA 3: JET

The full exploitation of JET in its phases of deuterium plasmas, in the context of a prolongation of the Joint Undertaking to 1996, will be completed by establishing reliable methods of plasma purity control under conditions relevant for the Next-Step tokamak. Where appropriate, JET equipment and expertise will be used to perform specific developments in support of the Next Step. A substantial contribution to the JET programme will be provided by the Associations, both by supporting activities (see Area 4) and by transfer of staff.

Furthermore, preparation will be undertaken for the final phase of JET with deuterium-tritium plasmas, planned to take place in 1995 and 1996. A rigorous scientific, technical and safety assessment will be carried out as part of this preparation.

AREA 4: SUPPORT PROGRAMME

— **Scientific support to the Next Step and to JET**

The activities of the specialized devices within the Associations will be focused on work programmes in support of the Next Step and of JET as well as on exploration of concept improvements. In particular studies on confinement, magneto-hydrodynamic stability, plasma-wall interaction, fuelling and exhaust, heating and current drive, will be carried out on existing devices: Tore-Supra, Asdex-Upgrade, Textor, FTU, Compass, TCV, RTP and Isttok. A revised proposal concerning a compact tokamak, Ignitor, might be submitted for in-depth examination.

New plasma diagnostic methods will be developed and theoretical activities, in particular on plasma modelling, will be carried out to support these studies.

— **Studies on alternative lines in toroidal magnetic confinement**

The newly built stellarator, Wendelstein VII-AS, will be fully exploited. Subject to the outcome of an in-depth examination, the engineering design of a large advanced stellarator, Wendelstein VII-C could be undertaken. The possible construction of such a device would be considered within the 1993 to 1997 Framework Programme. Another stellarator, TJ-II, is being constructed for operation to start in 1995.

Following its completion in 1991, the large reversed field pinch, RFX, will investigate plasma confinement and plasma purity at high current. The construction of Extrap-T2 will be completed and its exploitation undertaken.

Some devices, such as the Asdex and TCA tokamaks and the reversed field pinches HBTX, have been phased out having completed their experimental programmes; the full exploitation of the acquired data will be completed; several smaller devices, such as the stellarator STORM, the reversed field pinches ETA-BETA II and Extrap-T1 will be phased out after completion of their experimental programmes.

— **Other Approaches to controlled fusion**

Current work going on elsewhere on other approaches to controlled fusion will be followed closely. The present keep-in-touch activity with inertial confinement fusion will be continued, subject to a periodic reassessment of its reactor potential compared with that of magnetic confinement fusion.

ANNEX II

INDICATIVE ALLOCATION OF FUNDS ESTIMATED AS NECESSARY

Area	(ECU million)
1. Next-step design	75
2. Long-term technical developments	21
3. JET	210
4. Support programme	105,84
Total	411,84 (1) (2) (3)

(1) For Areas 1, 2 and 4, this includes administrative costs amounting to ECU 4,5 million and staff costs amounting to ECU 34,5 million. The budget of the JET Joint Undertaking includes provisions of approximately ECU 50 million for a maximum of 191 temporary employees assigned to the JET Joint Undertaking within the meaning of Article 2 (a) of the Conditions of Employment of Other Servants of the European Communities; the Community participation in the JET budget is about 75 %.

(2) An additional amount of ECU 42 million will be allocated to JRC research in the field of controlled thermonuclear fusion, including an amount of ECU 0,42 million representing the JRC's contribution to the centralized scheme for the dissemination and exploitation of results under this specific programme.

(3) An amount deemed necessary of ECU 4,16 million, not included in the ECU 411,84 million, will be earmarked as the contribution from the specific programme on controlled thermonuclear fusion to the centralized scheme for the dissemination and exploitation of results.

The breakdown between different areas does not exclude the possibility that projects could cover several areas. In particular, safety and environmental issues which will govern the evolution of the Fusion Programme will be adressed in all areas; in JET, these issues are an integral part of the exploitaiton of the device; in Areas 1, 2 and 4 approximately 10 % of the total will be allocated to these issues.

ANNEX III

DETAILED RULES FOR IMPLEMENTING THE PROGRAMME AND THE AMOUNT OF THE COMMUNITY'S FINANCIAL CONTRIBUTION

1. The Commission will implement the programme on the basis of the scientific and technical objectives and content described in Annex I.

2. The detailed rules for implementing the programme, referred to in Article 3, comprise research and technological development projects, the JET Joint Undertaking, accompanying measures and concerted actions. Selection of projects must take account of the criteria listed in Annex III to Decision 90/221/Euratom, EEC and of the objectives set out in Annex I to this programme.

A. Research projects

The projects must be the subject of shared-cost research and technological development contracts in the framework of Contracts of Association with Member States, organizations in the Member States, Sweden and Switzerland; the JET Joint Undertaking; the NET Agreement (to be extended and/or modified in view of the possible Euratom participation in ITER); the Long-Term Development Agreement (to be established) and other contracts of limited duration.

Community financial participation in the running expenditure of the Associations will normally be at an annual uniform rate of approximately 25 %. After consulting the CCFP, the Commission may finance:

— the capital cost of specifically defined projects at an annual uniform rate of approximately 45 %,

— certain tasks which can be exclusively carried out by industry at a rate of up to 100 %.

Universities and other research centres participating in shared-cost projects outside the framework of the Contracts of Association will have the option of receiving, for each project, either the uniform rates of funding on the total expenditure or twice the uniform rates of funding on the additional marginal costs.

Shared-cost research projects must, as a general rule, be carried out by participants established in the Community, Sweden and Switzerland. the projects, which may involve, for example, universities, research organizations and industrial firms, including small and medium-sized enterprises, should, where possible, provide for participation by at least two mutually independent partners established in different Member States of the Community and/or Sweden and Switzerland.

The projects shall be selected on the basis of the ordinary procedures defined in the Contracts of Association, the JET Statutes, the NET Agreement, the Long-Term Development Agreement (to be established), and any Community-wide agreements that may be concluded following the advice of the Consultative Committee referred to in Article 5. For projects that are awarded priority status by than Consultative Committee, all Associations shall have the right to take part in the experiments carried out on the equipment thus constructed.

B. Accompanying measures

The accompanying measures will consist of:

— the organization of seminars, workshops and scientific conferences,

— internal coordination through the creation of inteegrating groups,

— advanced technology training programmes, with emphasis being placed on multi disciplinarity,

— promotion of the exploitation of results,

— independent scientific and strategic evaluation of the operation of the projects and the programme.

C. Concerted actions

Concerted actions consist of action by the Community to coordinate the individual research activities carried out in the Member States. These actions benefit from funding of up to 100 % of coordinating expenditure.

3. The knowledge acquired in the course of the projects will be disseminated both within the programme and by means of a centralized activity, pursuant to the Decision referred to in Article 4 (3) of Decision 90/221/Euratom, EEC.

COUNCIL DECISION

of 19 December 1991

adopting the work programme for the implementation of the specific programme of research and technological development in the field of industrial and materials technologies (1991 to 1994)

(91/679/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Council Decision 91/506/EEC of 9 September 1991 adopting a specific programme of research and technological development in the field of industrial and materials technologies (1991 to 1994) [1], and in particular Article 6 (4) thereof,

Having regard to the proposal of the Commission,

Whereas Article 5 (2) of the abovementioned Decision provides that a work programme shall be drawn up setting out the detailed objectives and types of projects to be undertaken, and the financial arrangements to be made for them;

Whereas the first indent of Article 7 (1) of the said Decision provides that the procedure laid down in Article 6 thereof shall apply to the preparation and updating of the work programme;

Whereas, in conformity with this procedure, a draft work programme was submitted to the Committee assisting the Commission and whereas the former did not deliver a favourable opinion within a time limit which the Chairman laid down, and, following this same procedure, it is incumbent upon the Commission to submit to the Council a proposal on the measures to be taken,

HAS DECIDED AS FOLLOWS:

Sole Article

The work programme set out in the Annex is hereby adopted.

Done at Brussels, 19 December 1991.

For the Council

The President

P. DANKERT

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(1) OJ No L 269, 25. 9. 1991, p. 30.

ANNEX

I. BACKGROUND

This programme is a direct follow-up to the Brite/Euram and Raw Materials-Recycling programmes. Its general objective is to contritube to the rejuvenation of European manufacturing industry by strengthening its scientific base through research and technological development. Research and technological development effort will be directed towards integration of all aspects of the life cycle of materials and products and will also take account of the more severe constraints as regards acceptability of technological developments. These will include protection of the environment, working conditions, the continuous adaptation of the skills of the workforce to technological change, and new methods of management and organization to ensure a smooth and effective relationship between technology and the working world.

The present work programme is prepared in compliance with Article 5 (2) of Decision 91/506/EEC. It includes the following sections:

— detailed objectives and research tasks,

— implementation: call for proposals, types of projects, financial arrangements.

While a single research proposal need address only one element of the life cycle, it is to be expected that preference will be given to proposals anticipating results arising from a multidisciplinary approach with a breadth of eventual applications. Particular attention will be paid to initiatives which provide the widest accessibility of results to potential exploiters and eventual users, taking account of the legitimate rights for the protection of intellectual and industrial property.

II. DETAILED OBJECTIVES AND RESEARCH TASKS

AREA 1: MATERIALS — RAW MATERIALS

The focus is on improving the performance of both advanced and traditional materials at a cost which permits competitive industrial exploitation over a broad range of applications. This extends to impriving the technologies to ensure the supply of raw material resources and for recycling, so promoting an integrated approach to the whole life cycle of materials. It also includes the cost effective use of new materials in a broad range of products and applications and their diffusion to new application fields.

RAW MATERIALS AND RECYCLING

1.1. RAW MATERIALS

1.1.1. **Exploration technology**

Objectives

To provide new or improved low-cost tools and better geological concepts for use in the mining industry in exploration. To improve the know-how and hardware in this field and detection-monitoring techniques and mapping of polluted mine areas.

Research tasks

1.1.1.1. To develop and test advanced approaches for the exploration and the discovery of deposits and evaluation of known targets.

1.1.1.2. To refine deposit models and exploration concepts.

1.1.1.3. To refine methods and techniques for the calculation of ore reserves.

1.1.1.4. To develop and improve integrated systems based on multidata analysis.

1.1.1.5. To develop and test new and improved cost effective geophysical and geochemical exploration methods such as transient electromagnetic measurements (TEM), optical spectrometry and analysis of platinum group elements (PGE).

1.1.1.6. To apply and assess recently developed exploration techniques such as ground geophysical like georadar, seismic methods and airborne systems and to evaluate their potential for broader application.

1.1.1.7. To develop advanced exploration equipment like miniaturization of instruments such as spectrometers and downhole logging tools, and to develop more cost-effective drilling techniques.

1.1.1.8. To develop and test exploration techniques for environmental monitoring, detection and mapping of polluted areas around mines and quarries (see also 1.1.2.7. and 1.2.2.8.).

1.1.2. **Mining technology**

Objectives

To develop techniques which can bring about an increase in productivity, such as an amelioration in the operating costs of mining operations, having regard to environmental and safety aspects and the ability to assess the social and economic impact of mining and quarrying.

Research tasks

1.1.2.1. To develop techniques and systems for rock cutting and continuous quarrying and mining.

1.1.2.2. To develop specialized techniques to improve safety and working conditions, and environmental protection.

1.1.2.3. To develop selective exploitation methods minimizing waste production (see also 1.1.3.6).

1.1.2.4. To develop new concepts for open pit mining as well as new concepts to optimize and integrate mining unit operations such as backfilling, drilling, blasting and transportation.

1.1.2.5. To improve the modelling and practical technologies for supporting systems, rock reinforcement and stability.

1.1.2.6. To develop multidata analysis and advanced modelling and simulation for computer aided management and planning of mining operations.

1.1.2.7. To develop simulation and modelling, and experimental techniques to optimize the rehabilitation of redundant sites of mines including their use for waste disposal (see also 1.1.1.8).

1.1.2.8. To develop techniques which assess the social and economic consequences of placing environmental constraints on mines and quarries (see also 1.1.1.8).

1.1.3. **Mineral processing**

Objectives

To improve existing processes and to develop innovative technologies to be applied to full scale operations based on laboratory scale research and to optimize methods and techniques used in the various treatments of mineral concentrates, tailings and residues of mines and metallurgical plants in order to reduce production costs of new and existing plants and alleviate environmental problems.

Research tasks

1.1.3.1. To characterize industrial minerals and stones in order to improve their processing technology and suitability for alternative uses.

1.1.3.2. To improve physical and chemical mineral separation techniques.

1.1.3.3 To improve techniques for mineral processing and extractive metallurgy such as hydro-, biohydro-, and electro and pyrometallurgy (including slag chemistry).

1.1.3.4. To develop technologies which will reduce emissions and energy consumption and increase the range of acceptability of feed materials and stone processing plants.

1.1.3.5. To develop methods and techniques for the fixation and stabilization of metals and toxic compounds in final residues, mining wastes, slags and tailings.

1.1.3.6. To develop new process routes and equipment which optimize quality yield, and minimize production of waste (see also 1.1.2.3.).

1.1.3.7. To develop instrumentation, particularly sensors, for monitoring processes, materials and product quality.

1.1.3.8. To develop methematical models and simulations processing and extractive metallurgy unit processes and their integration into operating plants. To develop expert and automated systems.

1.2. RECYCLING

1.2.1. **Recycling and recovery of industrial waste including non-ferrous metals**

Objectives

To develop new technologies for physical and/or chemical treatment of residues, scraps and industrial waste in order to improve the recovery rates and minimize environmental problems. Research in this respect will cover pyrometallurgy, hydrometallurgy and refining techniques applied to processing of complex residues, alloys and multi-element scraps.

Research tasks

1.2.1.1. To characterize, identify, classify and quantify secondary materials and used non-ferrous metals airising from industrial activities. To develop quality contol methods for secondary materials before recycling, utilization or controlled disposal.

1.2.1.2. To optimize existing separation, concentration and recycling processes at industrial level, in respect to energy saving, flexibility of feed, concentration and reduction of emissions.

1.2.1.3. To develop new separation, concentration and recycling processes for more efficient recovery of valuable materials from scraps and industrial wastes including linings of refractory materials avoiding external contamination.

1.2.1.4. To develop cost effective pyrometallurgical processes such as plasma and laser processes capable of accepting fluctuations of feed concentrations to recover basic, special and precious metals originating from industrial sectors, metal industry wastes, complex residues, spent catalysts, used goods and equipment.

1.2.1.5. To develop cost effective biohydrometallurgical, photocatalytic and hydrometallurgical processes to treat slags, residues, industrial liquid effluents and wastes for recovery of metals, salts and valuable materials, and decontamination to minimize pollution.

1.2.1.6. To develop advanced technologies for reduction and refining secondary products and wastes e.g. by: fluid-bed technology, aqueous electrolysis, vacuum distillation, plasma technology, molten-salt electrolysis, and chloride technology.

1.2.1.7. To develop technologies which recover and recycle metals from materials containing organic and metalplastic compound structures while minimizing environmental damage.

1.2.1.8. To develop computer bases models to assess the economic viability and availability of secondary materials for recycling and metallurgical models to predict the effect of multiple recycling on the characteristics and processibility of raw materials.

1.2.2. **Recycling, recovery and reuse of advanced materials.**

Objectives

To improve recycling technologies seeking to reuse advanced materials waste in order to enhance the quality of the new products or compounds having a high level of quality and economic value.

Research tasks

1.2.2.1. To characterize, classify and quantify advanced materials wastes and to develop quality control methods for secondary materials before recycling, reuse or controlled disposal.

1.2.2.2. To develop analytical and marking techniques for identification. To develop safe, cost-effective technologies for the recycling of residues and scraps, originating from organic and inorganic composite and other advanced materials.

1.2.2.3. To develop models to access the economic viability and availability of advanced materials for recycling and to predict the effects of multiple recycling on the physical characteristics and processibility of the initial materials.

NEW AND IMPROVED MATERIALS AND THEIR PROCESSING

1.3. STRUCTURAL MATERIALS

1.1.3. **Metals and metal matrix composites**

Objectives

To secure the advances needed to exploit fully the potential of new alloys, composites and their processing; and, in particular, the technologies to address the problems associated with series

production. Additionally, to develop high temperature resistant superalloys, intermetallics, metallic powders, metal glasses, hard metals, wear resistant alloys and coatings which are required for specific applications with complex design specifications.

Research tasks

1.3.1.1. To develop cost-effective technologies for the synthesis and production of metallic materials and alloys aimed at a broader range of final products with high quality and performance.

1.3.1.2. To develop alloys, structural intermetallics and metal matrix composite systems with specific performance properties, such as improved stiffness, increased strength-to-weight ratio, environmental and high temperature resistance.

1.3.1.3. To improve performance through the control of powder morphology and interface properties of metal matrix composites.

1.3.1.4. To develop thin or thick coating systems with improved functional properties for metallic substrates.

1.3.1.5. To apply computer simulation techniques linking micro and macro structural modelling.

1.3.1.6. To develop techniques for assessing the long term stability and behaviour of metallic materials.

1.3.2. **Ceramics, ceramic matrix composites and advanced glasses**

Objectives

To advance the understanding and technologies of areas of critical importance such as quality, processing and reliability with particular emphasis on economic processing and tough, defect-free products.

Research tasks

1.3.2.1. To develop high temperature materials with increased strength, toughness, ductility and resistance to corrosion and erosion.

1.3.2.2. To optimize powders as starting materials.

1.3.2.3. To develop cost-effective and high-yield processing techniques for high quality materials and which permit their diffusion into new application fields.

1.3.2.4. To improve consistency and reliability of components including long term in-service stability.

1.3.2.5. To improve thermal schock restistance, creep resistance, thermal insulation and high temperature oxidation and corrosion behaviour

1.3.2.6. To develop prohabilistic design methodologies for high performance engineering components.

1.3.2.7. To develop surface treatment technologies to aid manufacture and use in services..

1.3.2.8. To apply computer simulation techniques linking micro and macrostructural modelling.

1.3.2.9. To develop techniques for assessing the long term stability and behaviour of ceramic materials.

1.3.3. **Polymers and polymer matrix composites**

Objectives

To achieve a better understanding of the performance structure capabilities of these materials and to extend the understanding of the relationship between materials properties and their process routes. Such advances could come about by innovative design and processing practices. To respond to environmental concerns with new technical thermoplastics which retain their mechanical properties at higher temerpature, and which can be produced through the lower cost thermal processing routes.

Research tasks

1.3.3.1. To develop cost-effective polymeric materials, composites and fibres and adhesives for a broader range of application fields which have improved material properties such as resistance to aggressive environments, temperature, pressure, impact loading and solvents.

1.3.3.2. To develop polymeric materials with specific properties which minimise environmental impact, such as biodegradability, recyclability and reusability.

1.3.3.3. To develop cost-effective and high-yield processing techniques for high quality materials.

1.3.3.4. To investigate new types of composites such as molecular and self-reinforcing composites.

1.3.3.5. To assess composite fibre/matrix interfaces through development of non intrusive techniques.

1.3.3.6. To develop intelligent pre-impregnated semi-finished products for composite components, with applications where high strength and high toughness are required.

1.3.3.7. To develop intelligent process design and control techniques for polymeric materials and their composites.

1.3.3.8. To apply specific treatments for upgrading low-cost polymeric material into tailor-made high performance components.

1.3.3.9. To apply mathematical modelling for material, product and process optimization.

1.3.3.10 To develop combined and fully integrated transformation techniques. such as injection moulding, lamination, and multi-layer and sandwich formation, for innovative high performance structural materials.

1.4. FUNCTIONAL MATERIALS FOR MAGNETIC, SUPERCONDUCTING, OPTICAL, ELECTRICAL AND BIOMATERIAL APPLICATIONS

1.4.1. Magnetic materials

Objectives

To meet the requirement for new materials with improved magnetic properties, which are easily processed, as advanced magnetic materials including hard, semi-hard and soft magnets and their integration into components and systems.

Research tasks

1.4.1.1. To develop advanced magnetic materials, such as the new rare-earth types, with cost-efficient processing.

1.4.1.2. To develop materials and their processing with improved high temperature magnetic performance and to develop improved permanent magnetic bulk materials with increased energy product and improved volumetric efficiency for specific applications such as electric motors and other electrical devices.

1.4.1.3. To improve the structural capability of magnetic materials through innovative design of their synthesis, processing and control of composition.

1.4.1.4. To improve functional capabilities of magnetic materials through multilayer formation.

1.4.2. High temperature superconducting materials

Objectives

To develop high critical temperature and high-current and flux density superconductors for power applications capable of being combined with other materials at low processing temperatures. To understand the new superconducting materials and their intrinsic properties.

Research tasks

1.4.2.1. To develop reliable and cost-effective processing for the manufacture on high-current superconductor material components such as wires, cables and layers.

1.4.2.2. To establish a design methodology for increased component reliability, specially for the preparation of wires, cables, thin and thick-layers.

1.4.2.3. To develop processing routes such as sol-gel, mixing, sintering, spraying techniques for the preparation of well characterized and controlled powders for superconductors.

1.4.2.4. To increase the understanding of basic property/structure/stoichiometry relationships, including electrical and magnetic properties, as a function of phase segregation, anisotropy and grain boundary effects.

1.4.3. Electrical and ionic conducting materials

Objectives

To advance the synthesis/processing technology for electrically conducting materials and conducting material matrices which are at an early stage of technological development. The open up application

areas such as electric wires, energy storage and acoustic devices. To develop the materials necessary for fuel cell systems for the production of clean electricity. To better understand the limits of present technology and the means by which the limits can be surpassed by new processing methods.

Research tasks

1.4.3.1. To develop electrical materials with better conductivity, higher strength and fatigue properties, corrosion and thermal resistance and spark erosion behaviour.

1.4.3.2. To develop solid ionic conductor for solid electrolytes in energy conversion devices.

1.4.3.3. To develop conducting polymeric materials systems containing inorganic fillers for high-volume or for use in packaging and joining.

1.4.3.4. To establish the relationship between polymeric material structures and their electrical and acoustic properties.

1.4.3.5. To develop age-hardened alloys and multi-layered composite materials which combine high electrical and thermal conductivity or electron emissivity together with improved mechanical properties and corrosion resistance.

1.4.4. **Optical materials**

Objectives

To address the outstanding problems which include the availability of ultra-pure materials with low optical losses for transmission systems, and materials processing including materials fabrication by chemical vapour deposition processing for 2 or 3 dimensions.

Research tasks

1.4.4.1. To develop new glass types with variable light transmission properties along with cost effective technologies for their application.

1.4.4.2. To develop and characterize non-linear optical materials, including organic materials and intermediate products.

1.4.4.3. To develop active coatings such as magnetic, piezoelectric and chemical dye surface layers for sensors.

1.4.4.4. To optimize electroluminiscent, electrochromic, photochromic and thermochromic phenomena for producing optical materials with controllable light transmission and generation.

1.4.5. Biomaterials

Objectives

To meet the requirements for new biomaterials including metal alloys, ceramics, composites, glasses, polymers and adhesives for applications such as orthopaedic and dental implants, soft tissue and body fluid replacements, internal or external devices of permanent or temporary nature. To develop technologies for cost-effective operations for item manufacturing, clinical procedures and rehabilitative systems.

Research tasks

1.4.5.1. To develop special and medical grade materials with biocompatible and biofunctional properties for devices and load-bearing implants.

1.4.5.2. To develop techniques for innovative design, modelling and clinical testing of new structures and complex shapes components and devices combining all aspects of reliable bio-operational ability: human tissues and implant compatibility.

1.4.5.3. To develop surface treatment techniques for medical devices to prevent erosion and corrosion and improved bio-integration properties.

1.5. MASS COMMODITY MATERIALS

1.5.1. **Packaging materials**

Objectives

To improve the technologies needed for cost effective processing including automation and on-line control, including the introduction of natural materials, the substitution of toxic materials and the improved recycling of materials systems.

Research tasks

1.5.1.1. To develop environmental friendly packaging materials which are reusable, recyclable or degradable, and non toxie in use and disposal.

1.5.1.2. To improve current processing methods for increased productivity and for high added value packaging products.

1.5.2. **New construction industry materials**

Objectives

To improve materials currently used for civil construction and to develop new materials, including composites, able to combine functional and structural characteristics.

Research tasks

1.5.2.1. To develop new material technologies aiming at improved thermal insulation, sound shielding and mechanical integrity.

1.5.2.2. To develop introduction of novel production and assembly methods allowing a high degree of automation.

1.5.2.3. To investigate the degradation of construction materials and systems exposed to air, water, pollution, ultra violet radiation, temperature and humidity.

1.5.2.4. To develop structural adhesives which act as binders and reinforcement for hybrid prefabricated systems.

1.5.2.5. To develop techniques for the use of metallic or organic materials as reinforcement for concrete, glasses and ceramics, leading to systems with high corrosion resistance, good thermal and sound insulation and increased fire security.

AREA 2: DESIGN AND MANUFACTURING

The objective is to improve the capability of industry to design and manufacture products which are, at the same time, of high quality, easy to maintain, highly competitive and environmentally and socially acceptable.

2.1. DESIGN OF PRODUCTS AND PROCESSES

2.1.1. **Innovative design tools and techniques**

Objectives

To develop design tools such as decision support systems to promote more efficient design methods, more economic manufacture, assembly and dismantling, and reliable and ergonomic products.

Research tasks

2.1.1.1. To develop decision support systems for design in the areas of materials and standardized components which incorporate mathematical modelling, production characteristics, product performance and anthropometric data.

2.1.1.2. To establish methods for validation and certification of design support, modelling and analysis tools.

2.1.1.3. To develop techniques for minimizing the 'design to product' time based on value analysis, modelling, simulation and rapid prototyping techniques.

2.1.1.4. To develop a methodology for modelling of the whole engineering process from conceptual to detailed desing, including representation of functional tolerancing, and to validate the approach.

2.1.2. **Design methodologies for complex components**

Objectives

To develop approaches for the incorporation of multi-functional components in product design. To advance the capability of high precision and micro-engineering systems together with design for micro-miniaturization.

Research tasks

2.1.2.1. To establish new approaches to, and applications for, the design of multi-functional components.

2.1.2.2. To develop multi-disciplinary approaches to the design of integrated systems such as mechatronics, optomatronics, and multi-component systems.

2.1.2.3. To develop design methodologies for high precision and micro-engineering systeme relating to mechanics and materials behaviour at micro-structural level.

2.1.3. **Maintainability and reliability**

Objectives

To develop the support tools, including sensor systems, for improved product performance, reliability and maintainability. To advance the capability and applicability of mathematical modelling to support desing, including the integration of modelling techniques with defect and failure mode analysis needed for reliability and predictive maintenance.

Research tasks

2.1.3.1. To improve design methods and modelling capabilities for products and processes with respect to quality, reliability, durability, maintainability and safety.

2.1.3.2. To develop reliability support systems which provide information on component behaviour based on the analysis of their deterioration and failure.

2.1.3.3. To develop techniques for predictive maintenance including condition monitoring and vibration analyses.

2.1.3.4. To develop integrated system design incorporating sensors with improved performance and reliability.

2.1.3.5. To develop techniques for minimizing noise and vibration generated by products and manufacturing equipment.

2.2. MANUFACTURING

2.2.1. **Tools, techniques and systems for high quality manufacturing**

Objectives

To develop skill supporting technologies to make human skills and judgement more effective in the manufacturing process. To develop innovative tools and techniques for high quality and cost effective manufacturing systems to give better process control, higher precision and faster operation and the integration of new processing technologies with established manufacturing processes.

Research tasks

2.2.1.1. To develop improved models to exploit knowledge based systems for manufacturing processes.

2.2.1.2. To improve systems, which may include robotics, for workpiece fixturing, transport and safe handling in manufacturing.

2.2.1.3. To develop cost-effective manufacturing processes such as cutting, machining, grinding, forming, joining and bonding to improve productivity, quality and precision.

2.2.1.4. To develop cost effective high power beam processes, fibre optics for beam delivery systems, and associated acoustical and opitcal inspection and test techniques.

2.2.1.5. To develop and integrate technologies relating to high quality surface treatments within the manufacturing process.

2.2.1.6. To develop flexible and economic manufacturing systems for small batches of a large number of variants.

2.2.2. **Manufacturing techniques for industrial use of advanced materials**

Objectives

To develop cost-effective and efficient manufacturing techniques for advanced materials to help realise their full potential.

Research tasks

2.2.2.1. To improve and extend the capability for net and near net shape forming of advanced materials, including the automation of pre-formed manufacture.

2.2.2.2. To develop cost-effective machining techniques for difficult and advanced materials associated wherever possible with process modelling.

2.2.2.3. To develop and automate equipment for the economic manufacture of composites and ceramics.

2.2.2.4. To improve assembly and joining technologies for advanced materials and components.

2.2.2.5. To develop non-destructive tests and quality assurance techniques for adhesive bonds and composite materials.

2.2.2.6. To develop and extend surface treatment and surface finishing techniques suitable for advanced materials and methods for their inspection.

2.2.3. **Integrated approach to chemical and process engineering**

Objectives

To tailor manufacturing technology to the requirement of chemical engineering and to integrate design with process control. To advance the understanding needed to design and control chemical processes with increasing complexity to include avoidance and prevention of pollution.

Research tasks

2.2.3.1. To improve the design and control of chemical and biochemical reactors for increased flexibility, productivity and better product quality

2.2.3.2. To develop techniques to combine individual chemical process steps in material synthesis, material processing and particle technology through a better understanding of basic chemical and physical phenomena.

2.2.3.3. To develop innovative separation techniques (see also 1.1.3.2.).

2.2.3.4. To model chemical reactions which are important to manufacturing processes such as reaction injection moulding, etching, deposition and bonding.

2.2.3.5. To develop models of multi-phase systems and interfacial phenomena for process design and control

2.2.3.6. To develop a better understanding of processes in which reactions, catalysis and transport phenomena are strongly coupled, and where the product quality depends strongly on the coupling.

2.2.3.7. To optimize chemical engineering processes through an integrated approach to process design, modelling and control for recycling, environmental protection and process safety

2.3. ENGINEERING AND MANAGEMENT STRATEGIES FOR THE WHOLE PRODUCT LIFE CYCLE

2.3.1. **Design integrating strategies**

Objectives

To develop new and more holistic approaches to support the integration of engineering tasks for the whole product life cycle, such as simultaneous engineering concepts which bring together design, engineering and manufacturing.

Research tasks

2.3.1.1. To develop design optimization strategies and constraint modelling techniques for the whole product life cycle, including recycling and disposal.

2.3.1.2. To develop systematic approaches in the context of the extended enterprise to reduce design to product lead time, and increase manufacturing flexibility.

2.3.1.3. To extend multi-disciplinary approaches such as simultaneous engineering for integrating engineering tasks and engineering management tasks.

2.3.1.4. To extend novel design, redesign and costing practices, taking account of whole product life cycle, including recycling or disposal.

2.3.2. **Engineering**

Objectives

To bring an integrated approach making full use of new materials, new design and manufacturing technologies and process and product control to traditional manufacturing industries, with particular attention to new requirements for environmental control and improved working conditions.

Research tasks

2.3.2.1. To extend the field of application for flexible manufacturing techniques taking full use of new materials and new technologies.

2.3.2.2. To develop new design and engineering methods for ease of manufacture, assembly, use and dismantling of products, including ergonomic such as innovative approaches to prefabrication and modular design.

2.3.2.3. To develop interactive engineering techniques that will improve working conditions and ergonomics.

2.3.2.4. To develop engineering methodologies for extending the application of the total quality concept throughout the whole product cycle.

2.3.3. **Human factors in engineering and manufacturing management**

Objectives

To accelerate the take up of new technology by developing new management techniques which allow identification and reconciliation of potential areas of conflict between new technologies and human resources. To improve methods for the evaluation of the performance of products and processes and their linkage to the overall business.

Research tasks

2.3.3.1. To develop strategies for improving the management and organization of design, manufacture and construction so as to make the best use of available resources and new technologies.

2.3.3.2. To develop management supoort systems for the evaluation, control, forecasting and measurement of production requirements and resources within industry.

2.3.3.3. To develop techniques for quantifying, evaluating and matching human skills and experience with specific job requirements.

AREA 3: AERONAUTICS

The objective is to strengthen the technology base of the European aeronautical industry and to contribute to the knowledge base which supports actions to minimize environmental impact and enhance the safety and efficiency of aircraft operations.

3.1. ENVIRONMENT RELATED TECHNOLOGIES

Objectives

To provide new or improved tools and techniques for analysis, prediction and control of air vehicle exterior noise, interior noise and exhaust emissions.

Research tasks

3.1.1. To develop improved tools and techniques for prediction and control of exterior noise from advanced propellers, prop-fans and helicopter rotors.

3.1.2. To develop and evaluate cost effective for reducing aircraft interior noise.

3.1.3. To develop low emission combustor technology.

3.2. TECHNOLOGIES OF AIRCRAFT OPERATION

Objectives

To provide new or improved tools and techniques for monitoring the health of aircraft systems, designing structures resistant to fatigue, crash and fire, and for integration of the air vehicle in future advanced ATC systems.

Research tasks

3.2.1. To develop and validate improved design tools for treating acoustic fatigue.

3.2.2. To develop improved techniques for health and usage monitoring.

3.2.3. To develop improved techniques for crashworthiness analysis.

2.3.4. To develop improved techniques for fire risk analysis and detection.

2.3.5. To develop improved flight management/ATC interface techniques.

3.3. AERODYNAMICS AND AEROTHERMODYNAMICS

Objectives

To advance CFD techniques, laminar flow technology, tools for analysis of propulsion integration and techniques for analysis of the aerothermodynamics of turbomachinery.

Research tasks

3.3.1. To develop and validate new and improved CFD tools for flow solution, post processing and aerodynamic design optimization.

3.3.2. To develop improved techniques for natural and hybrid laminar flow control.

3.3.3. To develop improved experimental means for study of propulsion system integration.

3.3.4. To develop improved techniques for analysis of wing-mounted, ducted propulsion systems.

3.3.5. To develop improved tools for analysis of helicopter rotor/fuselage interaction.

3.3.6. To develop improved tools for analysis of axial and mixed flow compressor aerothermodynamics.

3.3.7. To develop improved tools for analysis of turbine aerothermodynamics.

3.3.8. To develop improved turbulence models (focused fundamental research only).

3.4. AERONAUTICAL STRUCTURES AND MANUFACTURING TECHNOLOGIES

Objectives

To advance techniques for realization of large pressurized composite fuselage structures.

Research tasks

3.4.1. To develop design concepts for pressurized fuselage structures of composite and/or metal laminate.

3.5. AVIONIC SYSTEM TECHNOLOGIES

Objectives

To provide new or improved techniques for design of modular, high integrity airborne information processing and sensing systems and for analysis and design of man-machine interaction on the flight deck.

Research tasks

3.5.1. To develop techniques and tools for integration and evaluation of complex, flight critical, fault tolerant avionic equipments and systems.

3.5.2. To develop and evaluate new and improved techniques for electronic and/or optical sensing and date processing, including standardization issues.

3.5.3. To develop improved techniques and architecture for flight critical signal processing and data fusion.

3.5.4. To develop advanced flight deck concepts and related techniques for optimizing man-machine interaction.

3.5.5. To develop improved techniques for design and analysis of the helicopter cockpit and its functioning.

3.6. MECHANICAL, UTILITY AND ACTUATION TECHNOLOGIES

Objectives

To provide new or improved techniques for design of key equipment components of the air vehicle system.

Research tasks

3.6.1. To develop and validate new concepts and modelling techniques for provision of the landing gear function.

3.6.2. To develop non-bleed air based techniques for de-icing and/or cabin conditioning.

3.6.3. To develop and validate advanced techniques for integrated fuel management systems.

3.6.4. To develop advanced techniques for electrically powered actuators with integrated electronic information processing.

4. TARGETED RESEARCH ACTIONS

The concept of targeted research actions is to secure added value by helping participants in complementary projects covering different technologies of the programme to coordinate their activities around one specific objective. This will be of importance to a range of industries made up of users and producers — including small and medium-sized enterprises (SMEs).

The scientific and technical content of the projects will draw on the research topics of Areas 1 and 2 of the programme and potential themes will be published with the normal call for proposals. Depending on the quality of proposals received, it is expected that approximately four targets will be selected for the first round.

Targeted research actions will seek, wherever possible, to encompass as wide a range of industrial activity compatible with achieving their specific objectives. Actions will normally come under one of the following categories, although, on the basis of proposals received, the Commission might suggest other subjects for this form of action:

4.1. **Environmentally friendly technologies**

(a) Manufacturing and materials technologies necessary for machines including vehicles, trains and ships, with reduced environmental impact particularly in terms of pollution, waste, safety, noise and consumption of materials along with user safety and acceptability. Accordingly, research and development could include:

— advanced design technologies leading to 'lean' supply,

— assembly technologies,

— recycling technologies,

— materials technologies covering composite material systems with the potential for improved performance and styling flexibility,

— manufacturing technologies for mass or 'lean' batch production to meet relevant quality, flexibility and cost constraints,

— mechanical and electrical systems as well as advanced braking systems, and

— internal and external noise and vibration suppression.

(b) Technologies for construction which are better suited to the needs of the user in terms of a controllable working environment and flexibility, and can be designed, constructed, maintained and reused in a safe and efficient manner with minimum impact on the environment. Research might include:

— design, materials, manufacturing and construction techniques;

— the development of specifications for performance requirements,

— simulation and calculation models for structural design, the scope and durability of new materials,

— flexible manufacturing and assembly systems and repair technologies.

4.2. **Flexible and clean manufacturing**

Technologies for reduced environmental impact, greater flexibility, efficiency and accuracy along with improved quality, productivity and fast response of each stage of product manufacture, for instance in the textile, clothing and distribution chain. Research could cover:

— process technologies, including precision machinery,

— materials development,

— automation,

— materials handling, including cutting and joining,

— quality control, and

— process management.

Technologies to integrate these stages, so that the manufacturing chain can respond quickly and efficiently to market needs and to environmental considerations with safer, less polluting and less wasteful processes, can also be envisaged.

III. IMPLEMENTATION

The programme will be implemented by means of research projects, concerned actions and accompanying measures.

1. R&D PROJECTS AND CONCERTED ACTIONS

With the exception of the accompanying measures, research will be implemented by means of shared-cost contracts and concerted actions. The indicative budget envidsaged for these activities over the duration of the programme is: raw-materials and recycling — ECU 80 million; materials — ECU 228,8 million; design and manufacturing — ECU 301,5 million; aeronautics (over three years) — ECU 53 million.

For shared-cost projects, Community financial participation will not normally be more than 50 % of total costs. Universities and other research centres participating in shared-cost projects will have the opinion of requesting, for each project, either 50 % funding of total expenditure or 100 % funding of the additional marginal costs. Shared-cost projects will include the following types of action:

— industrial research projects will have a minimum size of at least 10 man-years and must be in the range of ECU 1 to 5 million total costs in Areas 1 and 2 (for Area 3, projects should be typically in the range ECU 3 to 5 million), cover a period of approximately 3 years and include at least two industrial partners from different Member States,

— focused fundamental research projects, upstream of industrial research and requiring industrial endorsement, will be at least 10 man-years and ECU 0,5 million, and up to ECU 1 million, cover a period of two to four years and include at least two organizations from different Member States.

In the case of proposals, which by their nature, means of implementations or urgency, address an issue important to reinforce the scientific and technological basis of European industry and thereby the development of its international competitiveness, the Commission reserves the possibility to consider them, subject to the exemption procedure in accordance with Article 7 of Decision 91/506/EEC.

Cooperative research is intended for groups of undertakings, in particular SMEs, which do not have their own research facilities in order to resolve common technical problems. One or more outside organisations (research association, universities or undertakings) will be appointed to carry out the research. 50 % of the research costs of these projects, total costs up to ECU 1 million, will be covered for a period normally not exceeding two years. Proposals must be submitted by undertakings which are to take part in planning and piloting the research and implementing the results.

Concerted actions: consist of coordination by the Commission of research activities carried out in the Member States in specific areas. They may benefit from dunding of up to 100 % of coordinating expenditure (travel, workshops, publications) normally not exceeding ECU 0,4 million over a period of up to four years.

2. ACCOMPANYING MEASURES

The accompanying measures are intended to improve the effectiveness of the programme in particular by improving its accessibility and impact. They build on experience within Brite/Euram and raw materials and recycling. During the programme new ideas are expected to arise. The accompanying measures will be a continuous process over the duration of the programme.

The work will be carried out by way of:

— feasibility awards for SMEs whose principal activity is in manufacturing or processing of up to ECU 30 000 or 75 % of the costs of research undertaken within mine months to establish the feasibility of an innovative device, concept or process. The overall aim being to facilitate the participation of SMEs in collaborative research,

— specific, multi-disciplinary training will include the training role within projects and in particular to link research activities with other industrial functions oriented towards exploitation, transfer of results, codes and standards, industrial property rights etc.; specialized courses to provide the training necessary for the effective application of the technologies developed, and research fellowships which focus on the technical areas of the programme,

— seminars, workshops and scientific conferences,

— meetings of ad-hoc groups of experts (eg. on preparation of norms and standards, materials data bases, emerging technologies, definition of research priorities),

— study contracts,

— promotion of exploitation of results,

— an independent evaluation of the scientific and strategic aspects of the programme.

The indicative budget envisaged for these accompanying measures is ECU 20 million with 2 % of the total programme budget being allocated to training activities.

Schedule

A schedule of the activities, with indicative budgets for contracts, is shown in the following table:

Activity	Indicative budget MECU for contracts	Areas	Call opens	Deadline	Review and selection of proposals	Likely start of contracts
Industrial research	266	1, 2, 3*	July 1991*	mid-February 1992*	March/April 1992*	October 1992*
Focused fundamental research	33.5	1, 2, 3*				
Concerted action	3	1, 2				
Industrial research	221	1, 2	July 1992	mid-February 1993*	March/April 1993	November 1993
Focused fundamental research	28.5	1, 2				
Concerted action	3	1, 2				
Cooperative research	57	1, 2	Continues open until February 1993 with selection twice/year		from December 1991	from September 1992
Feasibility Awards	5	1, 2			from December 1991	from February 1992
Specific Training	11	1, 2, 3			from December 1991	from February 1992

* Area 3 will have an earlier call