# ANNEXES

## ANNEX I

## FIELDS OF RESEARCH CONCERNING NUCLEAR ENERGY REFERRED TO IN ARTICLE 4 OF THIS TREATY

### I. Raw materials

1. Methods for the prospecting and mining of base materials (uranium, thorium and other products of particular importance in the field of nuclear energy).

2. Methods of concentrating these materials and converting them into technically pure compounds.

3. Methods of converting these technically pure compounds into nuclear grade compounds and metals.

4. Methods for the conversion and processing of these compounds and metals as well as plutonium, uranium 235 or uranium 233, either pure or combined with such compounds or metals into fuel elements by the chemical, ceramic or metallurgical industries.

5. Methods of protecting such fuel elements against corrosion or erosion by external agents.

6. Methods of producing, refining, processing and preserving other special materials used in the field of nuclear energy, in particular:

(a) moderators, such as heavy water, nuclear grade graphite, beryllium and beryllium oxide;

(b) structural materials such as zirconium (hafnium-free), niobium, lanthanum, titanium, beryllium and their oxides, carbides and other compounds capable of being used in the field of nuclear energy;

(c) coolants, such as helium, organic liquids, sodium, sodium potassium alloys, bismuth, lead bismuth alloys.

7. Methods of isotope separation:

(a) of uranium;

(b) of materials in ponderable quantities which can be used in the production of nuclear energy, such as lithium 6, lithium 7, nitrogen 15 and boron 10;

(c) of isotopes used in small quantities for research.

### II. Physics applied to nuclear energy

1. Applied theoretical physics:

(a) low energy nuclear reactions, in particular neutron induced reactions;

(b) fission;

(c) interaction of ionizing radiation and photons with matter;

(d) solid state theory;

(e) study of fusion, with particular reference to the behaviour of an ionized plasma under the action of electromagnetic forces and to the thermodynamics of extremely high temperatures.

2. Applied experimental physics:

(a) the same subjects as those specified in 1 above;

(b) study of the properties of transuranic elements of importance in the field of nuclear energy.

3. Reactor calculations:

(a) theoretical macroscopic neutron physics;

(b) experimental neutron measurements; exponential and critical experiments;

(c) thermodynamic calculations and calculations of strength of materials;

(d) corresponding experimental measurements;

(e) reactor kinetics, reactor control problems and relevant experiments;

(f) radiation protection calculations and relevant experiments.

III. **Physical chemistry of reactors**

1. Study of changes in the physical and chemical structure and of alterations in the technical properties of various materials in reactors brought about by:

(a) heat;

(b) the nature of the agents with which they are in contact;

(c) mechanical factors.

2. Study of degradation and other phenomena produced by irradiation in:

(a) fuel elements;

(b) structural materials and coolants;

(c) moderators.

3. Application of analytical chemistry and analytical physical chemistry to reactor components.

4. Physical chemistry of homogeneous reactors: radiochemistry, corrosion.

IV. **Processing of radioactive material**

1. Methods of extracting plutonium and uranium 233 from irradiated fuels, and possible recovery of uranium or thorium.

2. Chemistry and metallurgy of plutonium.

3. Methods of extracting and chemistry of other transuranic elements.

4. Methods of extracting and chemistry of useful radioisotopes:

(a) fission products;

(b) radioisotopes obtained by irradiation.

5. Concentration and storage of useless radioactive waste.

V. **Applications of radioisotopes**

Application of radioisotopes as active elements or tracers in:

(a) industry and science;

(b) medicine and biology;

(c) agriculture.

VI. **Study of the harmful affects of radiation on living organisms**

1. Study of the detection and measurement of harmful radiations.

2. Study of adequate preventive and protective measures and the appropriate safety standards.

3. Study of the treatment of radiation effects.

VII. **Equipment**

Studies relating to the construction and improvement of equipment specially intended not only for reactors but also for any of the industrial and research installations required for the research activities listed above. As examples may be mentioned:

1. The following types of mechanical equipment:

   (a) pumps for special fluids;

   (b) heat exchangers;

   (c) apparatus for nuclear physics research, such as neutron velocity selectors;

   (d) remote handling equipment.

2. The following types of electrical equipment:

   (a) instruments for radiation detection and measurement, used particularly in:
   — prospecting for minerals,
   — scientific and technical research,
   — reactor control,
   — health and safety,

   (b) reactor control equipment;

   (c) low energy particle accelerators (up to 10 MeV).

VIII. **Economic aspects of energy production**

1. Comparative studies, both theoretical and experimental, of the various reactor types.

2. Technical and economic study of fuel cycles.

## ANNEX II

## INDUSTRIAL ACTIVITIES REFERRED TO IN ARTICLE 41 OF THIS TREATY

1. Mining of uranium and thorium ore.
2. Concentration of such ores.
3. Chemical processing and refining of uranium and thorium concentrates.
4. Preparation of nuclear fuels, in any form.
5. Fabrication of nuclear fuel elements.
6. Production of uranium hexafluoride.
7. Production of enriched uranium.
8. Processing of irradiated fuels for the purpose of separating some or all of the elements contained therein.
9. Production of reactor moderators.
10. Production of hafnium-free zirconium or compounds thereof.
11. Nuclear reactors of all types and for all purposes.
12. Facilities for the industrial processing of radioactive waste, set up in conjunction with one or more of the facilities specified in this list.
13. Semi industrial installations intended to prepare the way for the construction of plants involved in any of activities 3 to 10.

## ANNEX III

## ADVANTAGES WHICH MAY BE CONFERRED ON JOINT UNDERTAKINGS UNDER ARTICLE 48 OF THIS TREATY

1.

(a) Recognition that public interest status in conformity with the national laws applies to the acquisition of immovable property required for the establishment of Joint Undertakings.

(b) Application of national procedure for compulsory acquisition on the grounds of public interest, so that such acquisition may be effected where amicable agreement has not been reached.

2. The right to be granted licences, either through arbitration or under compulsory powers as provided in Articles 17 to 23.

3. Exemption from all duties and charges when Joint Undertakings are established and from all duties on assets contributed.

4. Exemption from all duties and charges levied upon acquisition of immovable property and from all registration and recording charges.

5. Exemption from all direct taxes to which Joint Undertakings, their property, assets and revenue might otherwise be liable.

6. Exemption from all customs duties and charges having equivalent effect and from all prohibitions and restrictions on imports or exports, whether of an economic or of a fiscal nature, with regard to:

(a) scientific and technical equipment, excluding building materials and equipment for administrative purposes;

(b) substances which have been or are to be processed in the Joint Undertaking.

7. Exchange arrangements provided for in Article 182(6).

8. Exemption from restrictions on entry and residence for nationals of Member States employed by Joint Undertakings and for their spouses and dependent members of their families.

## ANNEX IV

## LIST OF GOODS AND PRODUCTS SUBJECT TO THE PROVISIONS OF CHAPTER 9 ON THE NUCLEAR COMMON MARKET

**List A**[1]

Uranium ores containing more than 5 per cent by weight of natural uranium.

Pitchblende containing more than 5 per cent by weight of natural uranium.

Uranium oxide.

Inorganic compounds of natural uranium other than uranium oxide and uranium hexafluoride.

Organic compounds of natural uranium.

Crude or processed natural uranium.

Alloys containing plutonium.

Organic or inorganic compounds of uranium enriched in organic or inorganic compounds or uranium-235.

Organic or inorganic compounds or uranium-233.

Thorium enriched in uranium-233.

Organic or inorganic compounds of plutonium.

Uranium enriched in plutonium.

Uranium enriched in uranium-235.

Alloys containing uranium enriched in uranium-235 or uranium-233.

Plutonium.

Uranium-233.

Uranium hexafluoride.

Monazite.

Thorium ores containing more than 20 per cent by weight of thorium.

Urano-thorianite containing more than 20 per cent of thorium.

Crude or processed thorium.

Thorium oxide.

Inorganic compounds of thorium other than thorium oxide.

Organic compounds of thorium.

**List A**[2]

Deuterium and its compounds (including heavy water) in which the ratio of the number of deuterium atoms to normal hydrogen atoms exceeds 1:5 000.

Heavy paraffin in which the ratio of the number of deuterium atoms to normal hydrogen atoms exceeds 1:5 000.

Mixtures and solutions in which the ratio of the number of deuterium atoms to normal hydrogen atoms exceeds 1:5 000.

Nuclear reactors.

Equipment for the separation of uranium isotopes by gaseous diffusion or other methods.

Equipment for the production of deuterium, its compounds (including heavy water) and derivatives, and mixtures or solutions containing deuterium in which the ratio of the number of deuterium atoms to normal hydrogen atoms exceeds 1:5 000:

— equipment operating by the electrolysis of water,
— equipment operating by the distillation of water, liquid hydrogen, etc.,
— equipment operating by isotope exchange between hydrogen sulphide and water by means of a change of temperature,
— equipment operating by other techniques.

Equipment specially designed for the chemical processing of radioactive material:

— equipment for the separation of irradiated fuel:
  — by chemical processes (solvents, precipitation, ion exchange, etc.),
  — by physical processes (fractional distillation, etc.),
— waste-processing equipment,
— fuel-recycling equipment.

Vehicles specially designed for the transport of highly radioactive substances:

— railway and tramway goods vans, goods wagons and trucks for tracks of any gauge,
— motor lorries,
— motorised works trucks for the handling of goods,

— trailers and semi-trailers and other non-motorised vehicles.

Containers with lead radiation shielding for the transport or storage of radioactive material.

Artificial radioactive isotopes and their inorganic or organic compounds.

Remote-controlled mechanical manipulators specially designed for handling highly radioactive substances:
— mechanical handling gear, fixed or mobile, but not being capable of being operated manually.

**List B** *(entry deleted)*

Lithium ores and concentrates.

Nuclear-grade metals:
— crude beryllium,
— crude bismuth,
— crude niobium (columbium),
— crude zirconium (hafnium-free),
— crude lithium,
— crude aluminium,
— crude calcium,
— crude magnesium.

Boron trifluoride.

Anhydrous hydrofluoric acid.

Chlorine trifluoride.

Bromine trifluoride.

Lithium hydroxide.

Lithium fluoride.

Lithium chloride.

Lithium hydride.

Lithium carbonate.

Nuclear-grade beryllium oxide.

Refractory bricks of nuclear-grade beryllium oxide.

Other refractory products of nuclear-grade beryllium oxide.

Artificial graphite in the form of blocks or bars in which the boron content is less than or equal to one part per million and in which the total microscopic thermal neutron absorption cross-section is less than or equal to 5 millibarns.

Artificially separated stable isotopes.

Electromagnetic ion separators, including mass spectrographs and mass spectrometers.

Reactor simulators (special analog computers).

Remote-controlled mechanical manipulators:

— hand-controlled (i.e., operated manually like a tool).

Liquid-metal pumps.

High-vacuum pumps.

Heat exchangers specially designed for nuclear power stations.

Radiation detection instruments (and spare parts) of one of the following types, specially designed, or adaptable, for the detection of measurement of nuclear radiation, such as alpha and beta particles, gamma rays, neutrons and protons:

— Geiger counter tubes and proportional counters,

— detection or measuring instruments incorporating Geiger-Muller tubes or proportional counters,

— ionisation chambers,

— instruments incorporating ionisation chambers,

— radiation detection or measuring equipment for mineral prospecting and for reactor, air, water and soil monitoring,

— neutron detector tubes using boron, boron trifluoride, hydrogen or a fissile element,

— detection or measuring instruments incorporating neutron detector tubes using boron, boron trifluoride, hydrogen or a fissile element,

— scintillation crystals, mounted or in a metal casing (solid scintillators),

— detection or measuring instruments incorporating liquid, solid or gaseous scintillators,

— amplifiers specially designed for nuclear measurements, including linear amplifiers, preamplifiers, distributed amplifiers and pulse height analysers,

— coincidence devices for use with radiation detectors,

— electroscopes and electrometers, including dosimeters (but excluding instruments intended for instruction purposes, simple metal leaf electroscopes, dosimeters specially designed for use with medical X-ray equipment and electrostatic measuring instruments),

— instruments capable of measuring a current of less than one picoampere,

— photomultiplier tubes with a photocathode which gives a current of at least 10 microamperes per lumen and in which the average amplification is greater than $10^5$, and any other types of electric multiplier activated by positive ions,

— scalers and electronic integrating meters for the detection of radiation.

Cyclotrons, Van de Graaff or Cockcroft-Walton electrostatic generators, linear accelerators and other machines capable of imparting an energy greater than 1 MeV to nuclear particles.

Magnets specially designed and constructed for the abovementioned machines and equipment (cyclotrons, etc.).

Accelerating and focusing tubes of the type used in mass spectrometers and mass spectrographs.

Intense electronic sources of positive ions intended for use with particle accelerators, mass spectrometers and similar devices.

Anti-radiation plate glass:

— cast or rolled plate glass (including wired or flashed glass) in squares or rectangles, surface-ground or polished but not further worked,

— cast or rolled plate glass (whether or not ground or polished) cut to shape other than square or rectangular, or curved or otherwise worked (for example, bevelled or engraved),
— safety glass, consisting of toughened or laminated glass, shaped or not.

Airtight clothing affording protection against radiation or radioactive contamination:
— made of plastic,
— made of rubber,
— made of impregnated or coated fabric:
  — for men,
  — for women.

Diphenyl (when it is in fact the aromatic hydrocarbon $C_6H_5C_6H_5$).

Terphenyl.

## ANNEX V

## INITIAL RESEARCH AND TRAINING PROGRAMME REFERRED TO IN ARTICLE 215 OF THIS TREATY

*(repealed)*