ANNEX II TO THE AGREEMENT BETWEEN
THE DEPARTMENT OF ENERGY OF THE UNITED STATES OF AMERICA
AND THE
NORWEGIAN MINISTRY OF PETROLEUM AND ENERGY
IN FOSSIL ENERGY RESEARCH AND DEVELOPMENT IN THE AREA OF
MULTITRACER TECHNOLOGY APPLIED TO PETROLEUM RESERVOIR STUDIES

WHEREAS, in the furtherance of their mutual interest the United States Department of Energy (DOE) and the Norwegian Ministry of Petroleum and Energy (MOPE) entered into the agreement in the field of Fossil Energy Research and Development signed April 22, 1987 (hereinafter referred to as the Energy R&D Agreement) which is set forth in the Appendix;

WHEREAS, MOPE has designated the Institute for Energy Technology (IFE) to act on its behalf for purposes of this Annex II;

WHEREAS, DOE and IFE (hereinafter referred to as the Parties) desire to cooperate in the field of fossil energy research and development;

WHEREAS, the Parties have a mutual interest in technology exchange on the application of multitracer technology in offshore petroleum reservoirs;

WHEREAS, the Parties have a mutual interest in exchanging samples and materials for testing multitracer technology in offshore petroleum reservoirs;

WHEREAS, Norway's Continental Shelf is known to be a prolific petroleum producing area, and therefore a prime candidate for evaluation and testing of perfluorocarbon multitracer technology studies;

IT IS AGREED AS FOLLOWS:

Article I - Scope of Work

The Parties shall cooperate in tasks in the area of multitracer technology applied to petroleum reservoir studies as set forth in Article II and in accordance with the terms and conditions of the Energy R&D Agreement.

Article II - Responsibilities of the Parties

The Parties shall carry out a series of tasks over the period of this Annex II as described below:

A. Technical Information Exchange

The Parties shall provide annual summaries of the activities in their respective tasks designated in Paragraphs B and C under this Article II.

B. Experimental Tasks Performed by DOE

Approximately 5.4 staff-years of DOE personnel effort in total shall be devoted
to:

Task 1. Develop multitracer perfluorocarbon tracers (PFT) injection, sampling, and analysis methodology for petroleum reservoir studies for the three distinct phases, i.e., oil, water, and gaseous hydrocarbon phase. These developments shall be based on the extension of the presently developed PFT technology and any additional development which may be needed.

Task 2. Determine the physical parameterization required for multi-PFT petroleum studies. This includes:

(a) Determining the partitioning coefficients of the PFTs in the various phases existing in both the petroleum reservoir and in the subsequent separation procedures.

(b) Determining relative absorption of the PFTs in the residual pore oil and adsorption on reservoir substrates.

This task shall entail close cooperation with IFE.

Task 3. Use the previously determined PFT/reservoir phase interactive parameters in computer modeling and simulation of proposed PFT-petroleum reservoir experiments to ascertain if such field experiments would be viable as determinators of the various physical properties of the reservoirs.

Task 4. Perform reservoir characterization field studies based on the results in the first three tasks. The field experiments to be emphasized, are those which shall assist petroleum reservoir engineers in their management of enhanced oil recovery (EOR) technologies, namely in the following areas:

(a) Relative PFT transport delay for EOR residual pore oil estimation.

(b) Reservoir bulk flow velocity determination.

(c) Efficiency of sea water or gas injection for EOR.

(d) reservoir management, i.e., once flow fields have been determined by the multitracer PFT techniques, decisions can be made as to where to inject for secondary or tertiary recovery and when to shut down.

C. Experimental Tasks Performed by IFE

Approximately 5.4 staff-years of IFE personnel effort in total shall be devoted to:

Task 1. Determine the physical parameters which characterize the interactions between tracers and reservoir rocks and fluids in order to optimize information from multitracer tests. These parameters will include:

(a) Determining the partition coefficients of PFTs in the various phases--gas, oil, and water.

(b) Carrying out laboratory experiments on the adsorption of various tracers on reservoir rocks.

Task 2. Use tracer simulation models to describe and analyze the behavior of tracers when applied in large scale, multiple-well, tracer projects.

Task 3. Examine clathrate-forming tracers for preferential partitioning to the water phase in cooperation with DOE.

Task 4. Seek opportunities for field applications and demonstrations of the tracer technology in cooperation with oil companies in order to test and demonstrate its applicability in petroleum reservoir characterization studies.

Article III - Management

Brookhaven National Laboratory (BNL) shall carry out DOE's technical responsibilities under Paragraph B of this Annex II.

Each Party shall designate a Project Manager for this Annex II. These Project Managers shall provide technical management and coordination of the tasks described in this Annex II.

The status of activities performed under this Annex II shall be reported to the Joint DOE/MOPE Coordinating Committee as described in Article IV of the Energy R&D Agreement.

Article IV - Funding

All costs resulting from cooperation under this Annex II shall be borne by the Party that incurs them, except as otherwise agreed in writing, and as provided in Article V. It is understood and agreed that the ability of each Party to carry out its obligations under this Annex II is subject to the availability of appropriated funds.

Article V - Exchange of Samples

Shipping costs for any samples required by either Party shall be the responsibility of the Party providing the samples. Inventions resulting from such exchange shall be owned by the inventing party in its territory and third countries and by the other party in its territory.

Article VI - Intellectual Property Rights

Article IX of the Energy R&D Agreement is hereby incorporated by reference (see Appendix).

Article VII - Invention or Discovery

Article X of the Energy R&D Agreement is hereby incorporated by reference (See Appendix).

Article VIII - General Provisions

Collaboration under this Annex II shall be in accordance with the laws and regulations of the respective Parties. All questions related to the Annex arising during its term shall be settled by the Parties by mutual agreement.

Article IX - Duration

This Annex II shall enter into force upon the later date of signature and shall remain in force for a period of 3 years. This Annex may be amended or extended only by mutual written agreement of the Parties.

This Annex II may be terminated at any time at the discretion of either Party, upon six months advance notification in writing by the Party seeking to terminate. Such termination shall be without prejudice to the rights which may have accrued under this Annex III to either Party up to the date of such termination.

FOR THE DEPARTMENT OF ENERGY
OF THE UNITED STATES OF AMERICA

Robert H. Gentile
Assistant Secretary
Fossil Energy

6-14-90
Date

INSTITUTE FOR ENERGY TECHNOLOGY
ON BEHALF OF THE NORWEGIAN MINISTRY
OF PETROLEUM AND ENERGY

Nils-Godtfred Aamodt
Managing Director

Aug. 2. 1990
Date