



DESCRIPTION OF ASSOCIATES PROGRAM OPERATION

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TOPICS

- **Brief Description**
- **Sample Agreement**
- **Status of Codes being Used or Developed by CEAR**



BRIEF DESCRIPTION

- **Administration:** The Center for Engineering Applications of Radioisotopes (CEAR) within the Nuclear Engineering Department at North Carolina State University (NCSU) administers the program – Robin Gardner is Director.
- **Research Projects:** These are either obtained from or approved by the Members of APNTOWL.
 - They may be individual or shared.
 - They may be public or proprietary.



BRIEF DESCRIPTION, 2

- ❑ **Obtaining Research Projects:** This is done early in the year either at a separate meeting or by e-mail with all members.
- ❑ **Annual Information Meeting:** Is held at a mutually agreeable site in the Fall. Research results are reported at the meeting.
- ❑ **Fee:** Each member agrees to pay \$20,000 per year and a one-time initiation fee of \$10,000. Enhancement grants for additional research are encouraged.
- ❑ **Expansion:** We would like to expand by both new members and increased enhancement grants.



ASSOCIATES PROGRAM - NUCLEAR TECHNIQUES of the CENTER FOR ENGINEERING APPLICATIONS OF RADIOISOTOPES AGREEMENT

This agreement is made effective the first day of January, 2008 by and between North Carolina State University at Raleigh, Raleigh, North Carolina (hereinafter called "UNIVERSITY") and Amoco Production Company (**Our First Member**), 501 Westlake Park Boulevard, P.O. Box 3092, Houston, Texas 77253-3092 (hereinafter called "MEMBER").

WHEREAS, the parties to this Agreement intend to join together in a cooperative effort to support the Center for Engineering Applications of Radioisotopes (hereinafter called "CENTER") at UNIVERSITY to maintain a mechanism whereby the UNIVERSITY environment can be used to develop better understanding of nuclear techniques in oil well logging, to stimulate innovations, and to provide UNIVERSITY with strengthened capability in these fields.

Now, therefore, for the mutual benefits and considerations each to the other, the parties hereto agree to the following terms and conditions:



**ASSOCIATES PROGRAM - NUCLEAR TECHNIQUES
of the CENTER FOR ENGINEERING APPLICATIONS OF
RADIOISOTOPES AGREEMENT, 2**

- A. CENTER will be operated by certain faculty, visiting scientists, and students at UNIVERSITY.**
- B. Any corporation or agency in the United States or abroad may become a sponsor of CENTER, consistent with applicable state and federal laws and statutes.**
- C. MEMBER agrees to pay a participation fee of Twenty Thousand Dollars (\$20,000) for the year 2008 (the one time initiation fee of Ten Thousand Dollars (\$10,000) is waived because of previous support) in support of CENTER and thereby become a sponsor of the Associates Program described in the attached Invitation, made a part hereof. Payment will be due upon final execution of this Agreement.**



**ASSOCIATES PROGRAM - NUCLEAR TECHNIQUES
of the CENTER FOR ENGINEERING APPLICATIONS OF
RADIOISOTOPES AGREEMENT, 3**

D. There will be a Member Research Board composed of one representative from each MEMBER. This board makes recommendations on (a) any joint research projects to be carried out by CENTER and (b) the apportionment of resources to these research projects.

E. UNIVERSITY reserves the right to publish in scientific journals the results of the research by the CENTER. MEMBER, however, shall have the opportunity to review any paper containing any of the results of the research program of CENTER sponsored by this Associates Program prior to submission of the paper for publication and shall have the right to request a delay in publication for a period not to exceed six (6) months from the date of submission to MEMBER to permit the filing of patent applications on any invention or discovery made by CENTER, provided that MEMBER makes a written request and justification for such delay within thirty (30) days from the date the proposed publication is mailed to MEMBER. Publication of information shall be permitted at any time, however, following the filing of a patent application thereon.



**ASSOCIATES PROGRAM - NUCLEAR TECHNIQUES
of the CENTER FOR ENGINEERING APPLICATIONS OF
RADIOISOTOPES AGREEMENT, 4**

- F. All patents derived from inventions conceived in the course of research conducted by personnel of the CENTER shall belong to the UNIVERSITY. With respect to each patented invention, conceived in the course of research conducted by personnel of the CENTER, UNIVERSITY thereby grants to MEMBER an irrevocable, royalty-free, nonexclusive license to practice such inventions and to make, use, and sell embodiments of the inventions filed after the date of the membership of the MEMBER provided that MEMBER shares in the costs of patent prosecution and maintenance. UNIVERSITY agrees to provide an executed specific license under any patent applications which may be filed and any and all patents which may thereafter issue on such inventions, if requested by MEMBER. MEMBER has the right to sublicense subsidiaries and affiliates. In the event of joint inventorship with a MEMBER employee, MEMBER has the right to sublicense subsidiaries and affiliates and other parties required to be licensed by MEMBER's license agreements. Subsidiaries and affiliates of MEMBER shall mean companies or businesses in which MEMBER has a fifty percent (50%) or greater ownership or a company in which MEMBER has an ownership interest and has been designated as the operator thereof.**



**ASSOCIATES PROGRAM - NUCLEAR TECHNIQUES
of the CENTER FOR ENGINEERING APPLICATIONS OF
RADIOISOTOPES AGREEMENT, 5**

G. Software developed by CENTER will be copyrighted by the UNIVERSITY. \ MEMBER will be entitled to an irrevocable, nonexclusive, royalty-free license to all copyrights developed by CENTER. MEMBER will have the right to sublicense its subsidiaries and affiliates. UNIVERSITY will not release copyrighted software for general public use until two (2) years after the software has been presented to MEMBER for use pursuant to the terms and conditions of membership in the Associates Program - Nuclear Techniques in Oil Well Logging of the CENTER. \ However, this license is primarily for MEMBER's internal use.

**NORTH CAROLINA STATE UNIVERSITY
CO.**

**By:
Name:
Title:
Date:**

AMOCO PRODUCTION

**By:
Name:
Title:
Date:**



STATUS OF MONTE CARLO CODES BEING USED BY CEAR Fall 2011

- **GENERAL MONTE CARLO CODE PHILOSOPHY:** The general purpose Monte Carlo code MCNP5 with the new geometry-independent fine-mesh importance map approach (first developed and implemented on MCNP by Lianyan Liu of CEAR) is used whenever possible. (We are also now using MCNPX for some problems.) The specific purpose Monte Carlo codes developed by CEAR are used in those cases where MCNP5 or X are not appropriate. This presently primarily includes tools and devices that involve neutron capture gamma- and X-ray spectrometry and pulse pile up.



STATUS OF MONTE CARLO CODES BEING USED BY CEAR Fall 2011, 2

- **THE CEARCPG MONTE CARLO CODE:** This code is for the prompt gamma rays produced by neutron activation analysis and it has been developed over about 20 years. It was originally developed based on the use of expected value splitting and detector response functions. It now contains the general geometry capability of MCNP (and now has the same input format) and uses the MCNP random number generator and cross sections. In addition to a total spectrum it also produces elemental library spectra for use in the Monte Carlo – Library Least-Squares (MCLLS) approach. This past year coincidence counting and differential operators have been added to its capability.



STATUS OF MONTE CARLO CODES BEING USED BY CEAR Fall 2011, 3

- **THE CEARXRF MONTE CARLO CODE:** This code is for X-ray Fluorescence analysis and it has been developed over about 25 years. It was also originally based on the use of expected value splitting and detector response functions. It has general geometry capability and incorporates the differential operator approach (including second-order direct and cross partial derivatives) for correlated sampling purposes. It also is capable of the simulation of the coincidence counting of K- and L-shell X rays.



STATUS OF MONTE CARLO CODES BEING USED BY CEAR Fall 2011, 4

- **THE CEARPPU MONTE CARLO CODE:**
This code is for the *forward* calculation of pulse pile up and was developed about four years ago. It is capable of rapidly predicting the observed (piled-up) spectra of any spectrometer with known pulse shape, counting rate, and true spectrum. It is available now from RSICC. We are presently investigating its applicability to DSP systems.



STATUS OF MONTE CARLO CODES BEING USED BY CEAR Fall 2011, 5

- ❑ **THE CEARIPPU MONTE CARLO CODE:** This code uses the CEARPPU code in an iterative fashion to obtain the true spectrum from the distorted pulse piled-up observed spectrum. It is available to APNTOWL members, but has not been submitted to RSICC as yet.
- ❑ **OTHER OLDER SPECIFIC PURPOSE CODES:** Older codes including ones for neutron and epithermal neutron porosity (CEARDNL and CEARENL) and for density and natural gamma rays (CEARLDL and CEARNGR) are still available. The last one still has features that are unique such as a number of scatters tally and the *pseudo* long detector concept.
- ❑ **OTHER CODES:** This includes codes such as NaI detector response Monte Carlo codes; other scintillation detector Monte Carlo codes for simulating nonlinear responses in BGO, LSO, etc.; and a Monte Carlo code for simulating the light response inside NaI and other scintillation detectors.

