



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

5/1/86

NOTE TO: Brian Sheron
FROM: Janet Gorn, OCA *[Signature]*

Enclosed is a list of University of Wisconsin personnel for the Nuclear Safety Research Center. Professor Michael Corradini requested that these names be sent to the proper EPA office for the Chernobyl Nuclear Power Plant List of Volunteers.

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Janet,

Professor Corradini said the Executive Committee consists of

Michael L. Corradini
William F. Vogelsang
Paul M. DeLuca
Gregory A. Moses
Max W. Carbon
Seymour Abrahamson
Al L. Wiley (Radiation Therapy)

Roxanne

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UW-MADISON NUCLEAR SAFETY RESEARCH CENTERINTRODUCTION

The Nuclear Safety Research Center is being created in the College of Engineering to carry out research, education, and public service related to technical issues of nuclear safety with specific emphasis on advanced reactor technology applications.

Over the past two decades, nuclear energy has become a vital source of power in the US and the world. In the former, there are now about 80 power plants on line and another 50 or so scheduled for completion soon. These 130 plants will produce about 20% of the nation's electricity, represent an investment on the order of \$300-400,000,000,000, and employ several thousand professional engineers. France and Japan will soon generate perhaps 50-60% of their electricity from nuclear energy, and developing countries such as China, Korea, Taiwan, and India expect to depend heavily on this form of energy also. Further, the importance and use of nuclear power are almost certain to increase in the future as the environmental restrictions associated with the burning of fossil fuels become more severe.

The safety record of the use of nuclear energy to generate electricity in the US and the world has been truly phenomenal. Not a single worker nor member of the public has been killed by radiation in a commercial nuclear power plant accident in the US, and the same statement applies worldwide as far as is known. Nevertheless, safety will always be a major consideration, and during the last few years, emphasis in the nuclear fission reactor industry (i.e. light water reactors) has turned from the design of new and unique plants to the safe and reliable operation of those plants currently on line and the plants coming into service before 1990. This shift in emphasis has also caused the design efforts in the advanced nuclear reactor concepts such as advanced converter reactors, the fast breeder reactor, and fusion power reactors to consider inherent safety and reliability within the context of the engineering design. This new emphasis on a 'better' new product and an 'improved' current product based on improved reliable operation and inherent safety, results in the need for research efforts in this area of high technology to be better focused.

The proposed Nuclear Safety Research Center would be a useful mechanism to help focus the research work that is currently underway at the University by a number of faculty. The Center would promote effective communication of the research work that is done in a number of specific engineering and scientific disciplines; e.g. health physics, two-phase flow and heat transfer, materials science, reactor physics. This communication would be within the University community to help participating faculty benefit from technical information on a common goal. The Center will also aid in communication with groups outside the University that may desire the results of such research or would like to financially contribute to its continuance. In addition the Center will help focus the research efforts in specific areas of safety and enhance the opportunity for collegial cooperation. This is especially important in a research area such as this where the interdisciplinary aspects of the work are quite important. Examples of some of the current research areas involving a variety of disciplines are

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- a) **Pressurized Thermal Shock:** This phenomena involves the sudden addition of colder water to a pressure vessel at relatively high temperatures resulting in possible structural failure by brittle fracture; this involves fluid dynamics and heat transfer expertise as well as structural mechanics and material science.
- b) **Radiological Source Term:** In certain postulated accidents it is important to understand the amount of radionuclides that might be released to the environment and their impact; this research again involves fluid dynamics and heat transfer expertise as well as chemistry, meteorology, health physics, and human oncology.
- c) **Liquid-Metal/Water Interactions:** In certain power plant designs use is made of liquid metals in combination with water; the potential for temperature excursions and explosions must be considered and this involves expertise again in heat and mass transfer, chemistry and structural mechanics.
- d) **Emergency Pressure Relief:** In many plant designs high pressure is utilized to optimize the thermodynamic efficiency of a power cycle or process; this requires the design and evaluation of systems with emergency pressure relief involving expertise in two-phase flow and heat transfer, structural mechanics and material science.

FUNCTIONS OF THE CENTER

The functions of the Center can be divided into three categories: research, education, and public service, although the primary effort will be on research.

Research

The Center's research activities will initially focus on nuclear safety issues. It is expected that the research programs will provide opportunities for cooperation with a number of industrial companies within the state of Wisconsin and nationally as well as state and federal government agencies. It is these groups that will provide the financial support for the research activities for the Center. Examples of industrial companies and government agencies that currently have given grants to faculty in the reactor safety area and who would potentially be interested in interaction with the Center include

Wisconsin Public Service Corp.
Northern States Power Company
Westinghouse Electric Corp.
ISPRA Joint Research Center
(European Common Market)
Argonne National Laboratory
Idaho National Engineering Lab
Nuclear Regulatory Commission
National Science Foundation

Madison Gas & Electric Company
Wisconsin Electric Power Corp.
Karlsruhe Nuclear Research Center
(Germany)
Sandia National Laboratories
Hanford Engr Development Laboratory
Electric Power Research Institute
Department of Energy

It is expected that the Center will also seek research support from other international groups that have benefited in the past from some of the efforts

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of specific faculty; e.g. Korean Atomic Energy Research Institute, Taiwan Institute for Nuclear Energy Research, Atomic Energy of Canada, and United Kingdom Atomic Energy Agency.

Education

Although the Center will not offer courses, it will support instruction of undergraduate and graduate students. For example, Center research programs will provide financial support for graduate students, and research results will be incorporated in formal courses. Several existing courses already benefit from safety research on the campus (e.g., NE/ME 520 "Two-Phase Flow and Heat Transfer," Med Phys/NE 569 "Health Physics," and NE 571 "Economics and Environmental Aspects of Nuclear Energy"), and new courses in the future will also benefit.

Research at the Center will provide bases for offering continuing education short courses involving safety issues. Professor Michael Corradini is currently preparing one such course based on his research. The Center facilities will make possible additional courses of wider scope.

While the Center will facilitate educational activities, all courses will be developed by faculty as a part of their responsibilities in their academic departments. The Center is not to assume the characteristics of an academic department.

Public Service

The Center will have access to equipment for experiments and theoretical calculations in the area of safety, and will have staff trained in the use of such equipment. This will enable the Center to assist any individual principal investigators not having the necessary expertise for a particular diagnostic test or usage of some specific type of computing equipment. The ability of the Center to address current safety issues will be of value to industry and to state and federal agencies as well as to University research investigators. Some of the prospective faculty members for the Center have research grants from Wisconsin industries dealing with specific issues in reactor safety. The Center will allow them to focus these efforts and derive the most benefit from the researchers for the particular industry.

FACULTY RELATED TO CENTER

The initial membership in the Center will include

Said I. Abdel-Khalik, Nuclear Engineering
 Seymour Abrahamson, Genetics & Zoology
 Max W. Carbon, Nuclear Engineering
 Richard J. Cashwell, Nuclear Engineering
 Kelly H. Clifton, Human Oncology & Radiology
 Michael L. Corradini, Nuclear Engineering
 Paul M. DeLuca, Jr., Medical Physics, Human Oncology, & Radiology
 M.M. El-Wakil, Mechanical & Nuclear Engineering
 James C. Hickman, Business & Statistics
 Jey K. Jeyapalan, Civil and Environmental Engineering
 David B. Johnson, Economics

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Gerald L. Kulcinski, Nuclear Engineering
 Edwin M. Larsen, Chemistry
 James B. MacDonald, Law
 Edward G. Lovell, Engineering Mechanics;
 Charles W. Maynard, Nuclear Engineering
 Gary L. Milhollin, Law
 Gregory A. Moses, Nuclear Engineering
 William F. Vogelsang, Nuclear Engineering
 Wilhelm G. Wolfer, Nuclear Engineering

Other faculty wishing to participate actively in the Center will be asked to join. The Center will have close ties with the Nuclear Engineering Department.

ADMINISTRATION

Organization

The Center will be organized as a subunit of the Engineering Experiment Station in the College of Engineering. Faculty participating in the activities of the Center will be asked to serve as members of a Faculty Advisory Committee. A Faculty Executive Advisory Committee will be selected from the Advisory Committee and the Center will have a director and any technical and clerical staff as deemed necessary. The director and committees of the Center will be appointed by the Dean of the College of Engineering with the concurrence of other academic deans as appropriate in the case of faculty from outside the College of Engineering. Any additional specific guidelines for operation of the Center will be determined by the director and the Faculty Executive Advisory Committee. This organizational structure is the same as that used for other Centers administered in the Engineering Experiment Station.

Facilities

The Nuclear Safety Research Center will initially be housed within the Engineering Research Building using the current space of the separate safety laboratories within the Nuclear Engineering Department. A plan for consolidation of our space needs has been considered and will evolve over the next couple of years. Any plans for expansion will be submitted to the Dean of the College of Engineering through the Engineering Experiment Station to ensure that it is unified and focused.

The current facilities for the Center include equipment for both experimental and theoretical work. For fundamental experiments some of the equipment includes the scanning electron microscope, a CO₂ continuous beam 300 watt laser, the Nuclear Engineering research reactor, reactor hot cell facilities, the Medical Physics 15 MeV neutron source, a liquid metal heat transfer and corrosion loop as well as the most up-to-date diagnostic and instrumentation equipment (e.g. hot-wire anemometer, micro-computer data acquisition systems). The computing facilities available for use by the Center include the IBM and Apple micro-computers within the experimental laboratories (e.g. three IBM XTs), the Nuclear Engineering micro-computer laboratory (IBM XTs and ATs), the MACC VAX, HARRIS, and UNIVAC computers, long distance links to supercomputers (CDC, CYBER, and CRAY machines), and the PSL

VAX 8600 and VAX 780. It is expected that additional equipment needs will be purchased with grant funds.

Financial Support

Financial support for the Center will be obtained from outside sources. Individual research grants and contracts by specific faculty associated with the Center will be handled in the usual manner. Any minor amounts of clerical support that may be initially needed will be provided by reallocation of resources within the Engineering Experiment Station.

RELATION TO ACADEMIC DEPARTMENTS

Faculty members involved with the Center will continue to carry on their usual activities through their own academic departments. The Center will allow the faculty the opportunity to conduct research in the area of reactor safety and benefit from the common focus of other colleagues. The Center will not become an academic department and will not serve as the primary base for any faculty.

Final Proposal
February 21, 1985

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