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July 28, 1993

Executive Director for Operations
U.S. Nuclear Regulatory Commission
Mail Stop 17G-13
Washington, D.C. 20555

Dear Sir:

In accordance with the provisions of the Code of Federal Regulations section 171.11(b), Washington State University herewith applies for an exemption from the annual license fees recently imposed upon University Research Reactors by the Commission. This exemption request is based upon the significant externalized benefits provided to the nation by the operation of the Washington State University TRIGA Research Reactor as enumerated below as well as the severe financial hardship that the license fee will place upon the WSU Research Reactor and Washington State University.

The following points address the question of whether nuclear education and research might "yield exceptionally large externalized benefits" -i.e., exceptional benefits that "cannot be captured in tuition or other market prices." What follows is a list of general areas to which nuclear education and research have contributed. These have been selected because they are of national interest and because society is not structured to "capture the benefit in tuition or market prices."

• Environmental Clean-up, especially DOE waste sites:

Trained people knowledgeable in nuclear technology and techniques are essential to meet the Federally mandated program to clean up the country's contaminated sites. The Federal Government through their contractors have hired and continue to hire people who were trained in radiochemistry at research reactors. One of our students who will receive his PhD this summer doing research using the WSU reactor is being hired by Westinghouse Battelle to work with the large waste tanks and Hanford. He not only carries with him a wealth of knowledge about radioactive isotopes and the associated radiochemistry but some of the techniques he will likely want to apply to the characterization of the wastes in the tanks would require a research reactor to perform. If our reactor or a similar reactor had not existed people with his expertise would simply not be available.

One more explicit example of a contribution our reactor is making to the problem of environmental waste clean-up is the work of Dr. Chien M. Wai. Dr. Wai and his students at the University of Idaho have been working on the development of supercritical fluid technology for the extraction of substances from solid and liquid materials. One of the more important supercritical fluids used in this manner is carbon dioxide at a temperature and pressure of 32°C and 73 atm., respectively. For example, decaffeination of coffee is accomplished by the treatment of regular coffee beans with supercritical carbon dioxide. The advantage of supercritical fluid extraction is that the extraction process leaves no contaminants behind in the treated products.

Unfortunately, metal ions do not interact with supercritical carbon dioxide effectively. However, Dr. Wai's research group has found that certain organic molecules called "ionizable crown ethers" can convert the metal ions into metal compounds making them soluble in a supercritical fluid. These crown ethers can be specially designed so as to be highly selective for the extraction of rare earth elements, such as lanthanum and lutecium, and transuranic elements, such as plutonium and neptunium. Dr. Wai is able to monitor the effectiveness of his designed crown ethers by following the progress of the rare earths and transuranics through the chemical and physical reactions using neutron activation analysis. Dr. Wai's work may lead to the development of safe and efficient new processes for mineral production and for the treatment of toxic metals and nuclear waste. Dr. Wai and his graduate students publish their work in public journals. The knowledge they create will be available to everyone and will benefit society in general.

• Maintain National Energy Self Sufficiency

The DOE wants reactors like ours to survive because they have long recognized that they need to maintain an infra-structure of knowledgeable and trained people who are capable of working on energy related projects that require nuclear technology. In recent years the DOE has invested large sums of money in upgrading the instrumentation of the existing reactors including ours at Washington State University. According to a recent IAEA Bulletin, 1/1993 page 52, 21.7% of our nation's electricity comes from nuclear power. Some regions of the country depend almost entirely on nuclear power. It is difficult to conceive of the existence of this important national energy resource without the prior research and development that was done and is continuing to be done at nuclear research reactors. The continuing survival of these power reactors and the development of future generations of safer and more economical reactors is dependent on the availability of talented and trained people many of whom will have received initial training at research reactors.

Eventually there is going to be a need for more uranium to fuel the world's and US reactors. In order to make nuclear fuel cheap and competitive we need to have the techniques to properly characterize the uranium ore deposits before and during extraction. A professor at Washington State University, Dr. Phil Rosenberg, developed the technique of using fission tracks in uranium sandstone quartz grains to age date the material. This technique, which requires a reactor, greatly enhances the ability of a geologist to characterize an ore body. A careful geological characterization of existing ore bodies helps to efficiently extract the ore while minimizing the amount of land that is disturbed and therefore minimizes the environmental impact of the mining activity. Understanding the ore body structures also helps the geologists to better predict where such ore bodies might form and therefore improves the efficiency of mineral exploration.

• Educate and Train People for Present and Future Technology

Washington State University (WSU) is a Land Grant University. We have long recognized the need to provide the state with trained and knowledgeable individuals who will make contributions to the state that far exceed the cost of training these people. At present WSU subsidizes approximately 2/3 of the cost of the average student's education. This fraction of subsidy is much greater for some of the physical and biological sciences which require expensive equipment and laboratory space. Also, any time the training requires laboratory work, the cost of the education of the individual is much greater than for most other disciplines. Society in general and WSU in particular has recognized this disparity because of the perceived benefits to society and does not in most cases charge extra simply because the particular discipline the student has chosen is more expensive. The exceptions are those disciplines where the expense is enormously greater, such as the training of medical doctors, however, society still sees fit to subsidize the education of doctors because of the recognized need for medical care that protects the health of society in general.

Society generally recognizes the benefit of having a repository of knowledgeable and talented people who are experts in complicated and expensive disciplines of knowledge. When individuals in society, or from government, need expert advise or knowledge in nuclear technology and techniques they know that they can call such places as the Nuclear Radiation Center at Washington State University and talk to someone who has a lifetime of experience working with nuclear instrumentation and techniques. In some cases the advice provided is going to save many lives indirectly because of subsequent research. I was recently contacted by a researcher who wanted to know if we could measure the iodine content of animal feed. There was a suspicion of a nutritional deficiency that might be traceable to iodine deficiency. We were able to immediately refer him to a professor in Chemistry, Dr. Roy Filby, who was interested in the detection of trace amounts of iodine in the environment.

- Promotion of Public Health Through Biological, Medical, and Environmental Research

A great variety of complex physical and biochemical processes are involved in essential physiological functions such as nutrition, excretion, respiration, metabolism, etc. Radioactive elements or compounds labeled with a radionuclide can be followed through a biological system by a variety of detection and imaging techniques. It was recently pointed out in a Biology and Medicine Division of the American Nuclear Society Newsletter that the work of ten of the last fifteen Nobel Prize winners in Medicine and Physiology could not have been possible if it were not for the availability of radioisotope labeled compounds. URR's supply short-lived isotopes such as ^{24}Na and ^{42}K to researchers for in vitro study of high blood pressure, cystic fibrosis, cancers, and other diseases.

Dr. Roy Filby, Dr. Barry Moore and a chemistry student at Washington State University are investigating the use of ponderosa pine tree annual growth rings as long term monitors of changes in heavy metal pollution of the Coeur d'Alene mining area. A 1/2 inch boring tool is used to take a core sample from a living tree without sacrificing the tree. Each tree ring contains material that was incorporated into it from its root system, thus each ring represents a sampling of the tree's local environment for a particular year. Neutron Activation Analysis on tree samples results in a determination of local contaminants such as Zinc and Cadmium which are by-products of mining activity.

- Promote and Develop High Technology to Remain Economically Competitive

One of the goals proclaimed and promoted by both major political parties is the development of small businesses. It is well known that a significant contribution to new job creation comes through small businesses. One of the new small businesses started at the Research Park associated with Washington State University is called International Sensor Technology. They have developed a new laser readout technique for reading Thermoluminescent Detectors (TLD's). Their work was supported by government SBIR and Navy grants to develop their techniques which the Navy plans to use to calibrate as many as 100,000 dosimetry badges each year. A significant and critical part of their work is carried out at our facility. It is difficult to imagine how they would have been able to accomplish their work without being located next to a our radiation center. The entire Nuclear Navy is going to benefit from their work. Their company has also developed new two-dimensional detector arrays which will be a significant advance in the way medical dosimetry will be done for cancer therapy.

- Promote and Improve Agricultural Research

Dr. C. W. Hunt and his associates at the University of Idaho "label" feed (such as straw or hay) for steers using rare earth elements (elements with atomic numbers between 57 and 71) as labels. These labels are sometimes referred to as tracers or markers. Such labeling permits the

experimenter to trace the progress of the artificially tagged nutrient through the digestive system of the animal. Ideally, the marker remains associated with the nutrient which is being investigated so that by detecting the marker one can monitor the passage of the labeled nutrient through the animal. Only very small quantities of the marker need be detected to keep track of where the nutrient goes. Samples collected from the animal or its feces are analyzed by neutron activation to quantify the rate of absorption of the tagged nutrient. Even small improvements in feed quality or feed utilization discovered with such methods can have great importance in agricultural economy and human nutrition.

- Protection of Endangered Species

Dr. S. Ristow and Dr. Gary Thorgaard in the Animal Sciences Department are doing research on homozygous clones of trout for biomedical research. They have NIH funding for this project. One of the most important public issues facing the Pacific Northwest is the protection of endangered Salmon in the Columbia and Snake Rivers. The resolution of this issue involves many activities including the generation of electrical power, river navigation, irrigation of agricultural land and of course fishing. WSU scientists are involved in various aspects of these problems. Some of this research requires utilization of irradiation facilities at the Nuclear Radiation Center.

- Inform the Public about Nuclear Technology and Nuclear Waste Management

Hundreds of public citizens, including Summer School Teachers, teachers bringing their classes, business groups, and scientists from around the world tour the reactor facility each year. Our facility is one of the most popular places to visit when people come to the Washington State University Campus. We discuss with these groups their concerns about nuclear technology. Each visitor receives two brochures, one of which is enclosed with this letter, namely "University Teaching and Research Reactors" and the other is about Commercial Nuclear Power Reactors. We are continually amazed at the misunderstandings most people have about nuclear technology. These tours are conducted free to the public. I think this activity is especially important because the public gets to directly express their concerns to experts in the field, scientists that they seem to have confidence in are providing them with factual information which is not biased towards any particular side of an issue because of conflict of interest.

- Support Geological Research which ultimately helps understanding Earthquakes, Volcanoes, Proper Resource Extraction and Management

We do a lot of work for the US Geological Survey and our local geology department. The technique of Neutron Activation Analysis enables geologists to easily measure trace elements in small quantities of rock or sediment without any complicating chemical or physical preprocessing. Such analysis of geological materials helps scientists to understand the fundamental processes that are involved in such phenomena as earthquakes, volcanoes and formation of mineral deposits. This research is published in the public journals and benefits everyone.

- National Defense

As mentioned under the section on high technology, we have research progressing at our facility that directly benefits the US Navy. It is easily arguable that much of the superiority of our US military can be attributed to nuclear technology developed by scientists just doing basic research at small reactors. The US is able to project its power globally because nuclear reactors can run for months without refueling. The manner in which we conducted the operation of Desert Storm would have been unimaginable without the nuclear technology that powers our aircraft carriers. Whether we like it or not, our Nuclear Navy has provided our country with a formidable shield that I believe has deterred many of our enemies from even thinking about assaulting us.

In closing, Washington State University urges the Commission to grant an exemption from license fees on the basis of the benefits provided to society by the continued operation of the facility as documented above. If such exemption is not granted, the severe financial hardship created by the imposition of the fees will likely precipitate the closing down of the WSU Research Reactor with the attendant loss to society of this invaluable educational and research tool.

Sincerely,

G E Tripard

Gerald E. Tripard
Director

enclosures: Summaries of activities, research, degrees, and publications, institutions served by the WSU Nuclear Radiation Center.
Brochure on Research Reactors handed out to the Public during reactor tours.

cc: James Holloway
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Dr. R.V. Smith, Vice Provost for Research & Dean, Graduate School
Washington State University
Dr. Thomas F. George, Provost, Washington State University