(NOTE: These summaries are offered only to provide insight into how some applicants addressed the criteria and the level of detail provided in their application. There is a wide range of methods used by various institutions in addressing the criteria as well as the amount of narrative deemed necessary. References to specific programs and individuals have been removed.)

Scholarships, Fellowships and Faculty Development Program ($15M) – Criteria and Examples

Recruiting/Marketing Criteria #1 ($15M) – Two Examples

Example #1

The Department has an established recruiting protocol. Most of the undergraduate recruiting is organized by the College of Basic Sciences and the College of Engineering, including a number of events such as BLANK Day and the Academic Showcase, which are targeted at the top prospective high school students across the state. During these recruiting events, prospective students receive personalized tours of the campus and their academic college of choice. In the College of Basic Sciences, departments set up information booths manned by faculty. The organizers pair up and introduce students interested in the targeted discipline, which provides opportunity for faculty members to discuss careers and research areas. The Medical and Health Physics Program is regularly represented by faculty in these events.

In the College of Engineering, students are given extensive tours of undergraduate and graduate laboratories and the ME machine shops accompanied by faculty members as well as undergraduate and graduate student volunteers. The students spend time with the members of the ME family and have the chance to ask questions regarding career paths in engineering and the challenges and benefits of the engineering curricula. A number of ME faculty members, especially the junior ones, and students participate in these activities. If successful in our present grant application, the scope of our recruiting effort will expand to include the areas of nuclear power Health Physics and Nuclear Engineering. The recruiting infrastructure and methods will be substantially similar to those currently employed and build on the existing procedures. One of our other department's website provides extensive information about our undergraduate programs, faculty, and other activities. The department has a recruiting program consisting of several components. Each year, brochures and program information are mailed to high schools throughout the state and in neighboring states. In addition, recruiting visits are made by members of the Undergraduate Recruiting Committee to select high schools in state; these recruiting visits present all of the department's undergraduate programs.

In February of each year, an Open House is held for students who are interested in our undergraduate programs. During the Open House, the Undergraduate Recruiting Committee organizes presentations by the department's research groups, tours of the campus and the major off-campus research facilities, and social events and meals that allow applicants to visit with faculty and graduate students. For some departments' applicants, the Open House includes one-on-one interviews with the faculty. In addition to this undergraduate recruiting targeted to freshmen and transfer students, we will implement an additional recruiting effort aimed at students who are already enrolled as undergraduate engineering or physics majors with an undeclared concentration or program of study. The scholarship program will be

advertised among these students via announcements in introductory-level courses, and will be a major component of our recruiting. We involve The Student Physics Society (SPS) in our recruiting effort and work with SPS to feature the opportunities provided by the Health Physics/Nuclear Engineering program. An SPS outing to BLANK nuclear plant will be scheduled each spring when freshmen and sophomores are making decisions about their concentration areas. The College of Engineering, in general, and the Mechanical Engineering Department in particular, employ similar approaches to undergraduate student recruiting. An "Engineering Extravaganza" weekend takes place at which middle and high school students from the surrounding region are invited on campus to explore a collection of hands-on exhibits and activities with the Engineering and Construction Management students, staff, and faculty. The ME undergraduate recruiting program is managed by Professors BLANK and BLANK aided by the faculty members of the Undergraduate Studies Committee. It also involves several ME faculty members who visit local high schools participating in outreach activities aimed at recruitment. This recruiting effort typically results in over 120 incoming ME students per year. The ME program already has several industry-sponsored scholarships in place for the recruitment of excellent students every year. The scholarship funds solicited through this proposal and the fact that the nuclear concentration under Mechanical Engineering will not require the students to commit until the end of their sophomore year provide us with the opportunity to direct our recruiting efforts internally and efficiently among the sizeable ME student body by advertising the attractive stipends, internships and co-ops, summer and postgraduate job opportunities, and research opportunities for students.

The ME Department already mentors our students and places them into internships and co-ops that are suited to their interests. This is done through a group of alumni volunteers with many years of experience who hold six interviews weekly with interested students. This opportunity is advertised through a broadcast e-mail to the student body from the ME Chair each semester and through an information and opportunity flat-screen located in the Student Center. A similar vehicle will be established on a bi-monthly basis for the recruitment and mentoring of students for the Nuclear Engineering program, with representatives of our industry partners (BLANK and BLANK) as mentors. This vehicle, and the scholarships themselves, will be advertised, especially among the freshmen and sophomore students, in ME and the College of Engineering in general. The College of Engineering runs a freshman level course, "Introduction to Engineering." Nuclear Engineering will be represented in this course through the participation of the new NE faculty and industry partner representatives. The student chapter of the American Society of Mechanical Engineers (ASME), which includes a large percentage of the undergraduate student enrollment, organizes monthly meetings during which industry professionals and/or faculty deliver lectures on their industry and their research respectively. These meetings will also be used to recruit students for the nuclear concentration/minor by inviting our industry partners to deliver lectures on the nuclear industry and to advertise the scholarships. The same will be done through the student chapters of the Society of Women Engineers (SWE) and the National Society of Black Engineers (NSBE). The university has a student chapter of the American Nuclear Society (ANS) that conducts its activities together with the student chapter of the Health Physics Society (HPS). The ANS and HPS student chapter members are active participants of the annual science week. During this time, students organize exhibitions and recruit students as society members. Regular meetings of these societies will provide opportunity for undergraduates interested in pursuing HP or NE carriers to get acquainted with current students in the program and obtain additional information on scholarship opportunities. The meetings of these societies may be jointly held with ASME. We conduct public outreach and science teacher training programs, as well, that have a strong but indirect influence on our student recruiting. Physics & Astronomy conducts monthly Saturday Science lectures by faculty on current research. These are advertised mainly to middle and

high school science teachers in the local area and across the state, and typically 200 students and teachers show up on a Saturday morning to hear lectures about our research.

Minority Student Recruiting (#1 continued)

One of the largest historically black universities in the US has an agreement with the university permitting students at one school to take courses at the other and receive full credit. To establish a closer linkage between the schools and, in particular, our departments, we have also established a program in which we have two faculty in Mechanical Engineering and two more in Physics with joint appointments at the two schools. These faculty teach at both schools and involve their students in their research programs. This gives us a natural means to recruit these MSI students into our programs. We will make use of this connection energetically to recruit African-American students into our Health Physics-Nuclear Engineering program. Through its Diversity Office, the College of Engineering also engages in targeted recruiting of underrepresented minorities and women. A residential 2-4 week camp is hosted each summer to encourage women and minorities to explore engineering career opportunities. The university is an active participant in the State STEM Research Scholars Program to recruit minority science students, assign them faculty mentors, and involve them in research groups. Students are recruited with scholarship money, jobs and research opportunities, extra counseling, special orientation programs, and personal attention.

Example #2

The Department of Nuclear Engineering will market the Graduate Fellowship Program nationwide to attract the best graduate students to the department. The department currently offers one-year support to outstanding graduate school applicants so that they may spend the first year on campus working with various faculty and exploring research opportunities. Students from nearby universities that have traditionally served under-represented groups will be targeted and encouraged to apply. The best students from these schools are of top quality and are frequently recruited out-of-state by other schools with substantial financial support. The proposed graduate fellowship program presents a valuable opportunity for an intensive recruitment effort. Due to the multi-year nature of the program, outreach can be made to undergraduate students at the time they are applying to graduate schools. This occurs during the fall of their senior year. Outreach to these schools is relatively easy because several MSI's are within a one or two-hour drive and can be visited on a day trip.

Further, the university faculty have existing research and education collaborations with faculty at these schools and host activities on our campus such as research meetings and summer internships. With the possibility of a fellowship, potential graduate students will be more likely to increase their exposure to our campus. Another marketing strategy will be to appeal to students who have a particular project in mind that is not currently funded through any faculty member. Fellowship support will enable these students to commence their research upon arrival on campus and eliminate the first year of departmental service. The fellowships used for these students can spark creativity in a way that is limited by financial realities. The "Request for Fellowship Proposals" is announced via the departmental website, email and networking. Potential graduate students who take advantage of paid campus visits through the existing recruitment program will also be informed of the fellowship opportunity.

Mentoring and Advising Criteria #2 ($15M) – Two Examples

Example #1

The NRC scholarship program will be jointly administered by the nuclear engineering program office and the Finance Office and Office of Student Services as well as the university Financial Aid Office. The program office will receive and evaluate the applications and make the scholarship awards. The financial office will establish and manage the scholarship funds and disburse the scholarship awards to the applicants. The university Office of Student Services will maintain the academic records of the recipients and assist in monitoring the progress of the students. Each scholarship recipient will use the dual advising system the program has developed to ensure success of the student. In this system, the student has an academic advisor and is assigned a nuclear engineering faculty advisor. The academic advisor advises and assists the student on curriculum matters and course scheduling, monitors student progress, and other student related matters. The faculty advisor assists the student in career options and the determination of technical electives to match the student's interests. When the scholarship recipient is a transfer student from another program within the university, the Principal Investigator will be assigned as the student's advisor. The academic advisor will have the responsibility to track the awardee's progress.

Example #2

The selection process will be managed by a committee that will be created for the proposed program. The scholarship program committee will be chaired and co-chaired by the PI and co-PI and comprised of the Nuclear Engineering undergraduate advisor, one junior or senior Nuclear Engineering faculty member, the Chair or Associate Chair of the department, and the department staff member in charge of student admission, advising and recruitment. In addition to the active recruitment of qualified students, the committee will approve the study schedule developed for the recipients of the scholarship in consultation with the undergraduate faculty advisor, monitor and advise recipients, examine the compliance of the recipients with their study schedules and disburse the funds at the end of each semester to those fulfilling the scholarship requirements. In addition to meeting with the NE undergraduate faculty advisor, the scholarship recipients will be scheduled for advisement and consultation with the PI and co-PI, at least once per semester. The US NRC scholarship program will measure the impact on our undergraduate enrollment in nuclear engineering by comparing with historical data in the department on such things as the average student GPA, years to graduation, and retention. [This scholarship program will also measure the effectiveness of recruiting the most qualified students from the local communities and nationally. We will develop a user-friendly website for the scholarship program to enhance our recruiting effort. The scholarship program committee will evaluate the program effectiveness by regularly examining (at least once per semester) the academic record of the scholarship recipients and conduct an exit survey of the graduates.]

Evaluation Plan Criteria #3 ($15M) – Three Examples

Example #1

The evaluation of the success in the university development plan for the new faculty member is aligned with our institution's promotion and tenure review. The success of our plan will be measured by a successful promotion and tenure review. While there will be other measures,

such as the successful completion of degrees by our students and new research accomplishments, the promotion and tenure process is inclusive of measuring those successes.

In evaluating a faculty member, the candidate's accomplishments are evaluated in the following categories: the scholarship of teaching and learning; the scholarship of research and creative accomplishments and service; and the scholarship of service to the university, society, and the profession. The assessment of each individual's accomplishments is completed in an integrated fashion in light of the department's responsibilities and aspirations. Traditionally, emphasis is placed on the first two evaluation categories rather than on the service component.

The scholarship of teaching and learning is evaluated through peer and student assessment of the courses that will be taught by the new faculty member. The department strives to ensure that our faculty teach courses in a number of categories including the following: courses required in our undergraduate curriculum, courses that are technical electives (not required, but rather special discipline courses), and graduate level courses. Peer assessment takes place by senior faculty in our department who evaluate all of our junior faculty's ability to deliver a clear lecture to our students. In addition, all teaching efforts are evaluated by students enrolled in the class through a "quality of instructor rating". These scores, and the peer assessments, are closely evaluated by our Committees, particularly for the required undergraduate courses. In addition, we evaluate our untenured faculty on the basis of their graduate advising, particularly the successful graduation of doctoral students. It is essential for our tenure-track faculty to advise numerous graduate students and have successfully graduated one or more students during their tenure years.

The scholarship of research and creative accomplishments is evaluated on the basis of archival publications that are reviewed by experts in the field and on the basis of securing competitive research grants. It should be clear to those that evaluate the tenure-track candidate that the individual is establishing a national, and sometimes international, reputation in a particular research area.

Service and the scholarship of service to the university, the public, and the profession are evaluated on the contributions that are made. These include, for example, organizing or co-organizing conference sessions that have an international attendance, serving on various departmental or college committees, and becoming active members in their professional organization. These service efforts lend to furthering the reputation of our Department as well as establish networking ties for the faculty member.

The three criteria listed above are evaluated through a dossier, prepared by the tenure-track faculty member with the assistance of the department, and through external evaluators. Typically, three to five evaluators external to the university are requested to review the tenure-track faculty member's dossier and latest publications.

The University, through the Nuclear Engineering Department, is well-positioned to have a successful faculty development plan for a newly hired faculty member. The teaching and research infrastructure are available to have this new faculty member be an integral part of a sustained and rich nuclear engineering program. The institution's promotion and tenure process is well-established and includes many opportunities to give feedback to the tenure-track faculty member. Our NE Department, in particular, has had a long history of successfully promoting with tenure young faculty members.

Example #2

ASSESSMENT AND EVALUATION

The success of this program must be defined in terms of the success of both the individual targeted recipients as well as the NE Program in general. After all, the two are integrally linked. This section is used to identify and explain some of the key metrics and assessment tools that will be used at both the programmatic as well as the individual levels.

PERFORMANCE METRICS

The following performance metrics apply to both the individual faculty in a program or department as well as the program/department as a whole. The last metric – rankings – obviously does not apply to individual faculty. In total, they represent a broad but focused picture of the quality and depth of a department's or a university's programs.

- scholarly output: The primary product of university research is publications, conference papers, books and book chapters. In recent times, patents have also become an important product of funded research. While publication rate is the easiest to quantify and benchmark, quality and relevance is probably more important. Good but imperfect metrics of quality include journal impact factors and numbers of citations. However, the following metrics also reflect on external recognition of the quality of work.
- placement of graduates: Our ability to place our students in important leadership tracks across industry, government and academe is a direct recognition by the nuclear engineering community of the quality of our education and research training programs.
- research expenditures: This metric is important not so much in terms of dollars (though that weighs heavily in the ranking formula), but as a measure of the national recognition of expertise and excellence of individuals and teams within the NE Program.
- faculty recognition and prominence: An important measure of quality is the type of recognitions a faculty member receives. Requests to serve on national advisory panels, membership in the National Academies and other such recognitions are clear indicators of quality and success. There are intermediate awards such as society fellows, awards, etc., which are important milestones of faculty and program progress.
- rankings: One of the most public and, probably, problematic metric is rankings, particularly those of US News & World Reports (USNWR). While there is much about the ranking process that is debatable, there is some degree of correlation between rankings and quality. For the past two years, NE at the university was ranked BLANK by USNWR. We are certainly improving in recognition and visibility.

ADVISORY PANELS

Independent, external feedback is critical to the success of any program or organization. There are four such sources of assessment that are used across NE in particular. Part of the function of at least two of these groups is to provide observations and advice on the overall progress and development of our junior faculty.

- Strategic Advisory Council (SAC): This is an external panel convened on a semiannual basis for NE in general, consisting of ~12 members from industry and government, mostly, but not exclusively, from the ranks of the university alumni/alumnae. There are currently three members who are specifically interested in the NE Program. In particular, they have been engaged in support of the ongoing comprehensive curriculum assessment and evaluation

exercises for each of the NE programs. This was also of great importance during the recent successful ABET accreditation review.

- NE External Advisory Panel: An external advisory panel was convened to provide independent assessment of the vision and potential of NE at The University. The panel included senior leaders from a government laboratory, a nuclear power company and two research universities. The panel provided candid comments and suggestions about NE, many of which have been folded into the vision and plans outlined in this proposal. A written report is available for detailing their observations. The leadership has assured the panel that, not only will their advice be carefully considered, they will be invited back to witness the changes and improvements made in response to their recommendations.

- ABET: The ABET evaluation, nominally visiting every six years, is truly an independent source of assessment and evaluation, albeit specifically focused on undergraduate programs. An ABET evaluation team visited the university in September 2007. The review and feedback was very positive.

FACULTY EVALUATIONS

Annual faculty evaluations by the NE Department Head are part of the annual salary adjustment process. The evaluation process for the previous year is now just about complete. The process entails each faculty member submitting a report quantifying research and teaching activities as well as identifying key contributions made in the area of citizenship. These are defined as activities that contribute to the life, growth and vision of the Program/Department. Faculty is required to simultaneously submit a five-year plan. This is reviewed by the department Head and discussed with the faculty member. The primary foci of the discussions are to be on how well the faculty member met goals set in the previous year and developing understandings of the goals of the faculty member for the next year. For the tenure-track assistant professor, this meeting is a mechanism through which the mentoring process is formalized and transmitted through all levels of the administration. These meetings and discussions provide a roadmap of the junior faculty member's progress in the run-up to tenure and promotion.

TENURE AND PROMOTION

Tenure and promotion is perhaps the most stringent and most important measure of success, not only of the faculty member, but also of the faculty member's home department. One can argue for any department in any university in the country, the department was culpable in a failed tenure and promotion case either through poor hiring, insufficient support and resources, poor mentoring, or insufficient professional development. Requirements for tenure and promotion to associate professor at the university are based on the following metrics:

- solid to excellent research as quantified by external evaluation by senior colleagues in the field, successful acquisition of external research funding, archival journal publications and conference papers, and the supervision of at least one student to the completion of the Ph.D. degree.
- solid to outstanding teaching with evidence provided through teaching evaluations by students, student reference letters and observations from faculty mentors. It is a clearly stated policy across the SOE that substandard teaching is grounds for denying tenure.
- demonstrated potential for leadership and collaboration through participation in multi-investigator research proposals and grants, contribution to the life, vision and growth of the

Department. It should be noted that, in a broader sense, these are the same metrics against which this particular grant and the entire NE Program should be evaluated. While it is unreasonable to set an expectation that everyone be outstanding in all facets of faculty activity, the blend of skills from each faculty should result in uniform excellence across the program.

Example #3

PERFORMANCE METRICS

Evaluation

The success of the program will be evaluated based on the objectives set forth in this proposal. Accordingly, by the end of the two-year period we ask: Did each fellow
1. Increase their GPA by at least 0.20?
2. Publish and present two scientific research papers?
3. Intern at Partner #1 in each summer? and
4. Join a federal facility, state facility, private company, or graduate school in a nuclear science, engineering and related discipline?

To achieve the first objective, the fellow will be provided with a monthly stipend so that they are not compelled to work outside campus to support their ends meet. Thus, this should be reflected in their academic performance and research accomplishments. Accordingly, their GPA performance will be reviewed after each trimester. The fellow will need to increase their GPA by about 1% each trimester to satisfy this objective. If the fellow does not meet the 1% criteria in a trimester, they will be put on probation for the following trimester and they will be purged from the fellowship program starting the trimester that follows if they are unable to increase their GPA by about 1% in their probationary trimester.

To accomplish the second objective, the fellow will be given the incentive of all-paid travel expenses to present their paper at a scientific conference. The fellow will be reminded of this requirement before their internship. They will be expected to submit a research paper for review by a conference during their summer internship or shortly thereafter.

The third objective is accomplished through the established partnership with Partner #1, which eases the fellow's compliance with this requirement. The fellow will be purged from the fellowship program if they skip on this requirement.

Lastly, every effort will be made to help students to accomplish the fourth objective to further their careers. Partner #1, including Y-12 Complex, will be our good starting point. After the fellow completed two internships at Partner #1, both the fellow and Partner #1 will be interested in full-time employment that can also help them with their graduate studies at Partner #2 nearby. Our partnership with Partner #3 will also help students if they choose to join the graduate school to further their education in nuclear science, engineering, and related disciplines. In addition, a Linked In group will be created to ensure that the PI stays in touch with the fellows to monitor their progress even after their graduation. This group will also help the fellows to stay in touch with each other and network to further their success in pursuing nuclear engineering- and science-related employment.

Institutional Support and Sustainability Criteria #4 ($15M) – Three Examples

Example #1

Through numerous discussions during our 2007-2008 strategic planning in the Nuclear Engineering Department, support was given by our faculty for strengthening our nuclear engineering program. Given the faculty age distribution in the NE Department and the loss of the two nuclear engineering faculty, as was previously mentioned, faculty hiring is of eminent importance. The NE Department is in the process of hiring one junior faculty member for our nuclear engineering program. This hiring should be completed by the end of the 2008-2009 academic year with the new faculty member to begin in the fall 2009. Funding from this NRC proposal will go towards the start-up costs for a second junior faculty hire whereby the faculty search will take place during the 2009-2010 academic year with a start date of fall 2010. In particular, the area of expertise for this second new faculty hire will be in advanced nuclear power generation.

Because of the tremendous interest of our students and industry, the NE Department has formed the Nuclear Power Advisory Board. We have confirmed Board memberships from 12 different organizations representing state economic development organizations; the nuclear power industry; and government agencies. This Board will guide our program's thrust in nuclear power to ensure we are meeting the educational and research needs of the industry. The first planned activity to be guided by the Board is a symposium on nuclear power that will take place in October 2009. The new junior faculty member, who will be hired if this proposal is successful, will be given full access to the Board members to further enhance his/her teaching, research and outreach activities.

The E&E Institute, which is an institute that crosses college boundaries, was formed with the intent of pursuing the newest research frontiers in energy and the environment. E&E Institute promotes cooperation across disciplines and the participation of the local, state, federal, and international stakeholders. In particular, the investment that the university has made into E&E Institute includes the creation of 24 new faculty positions across the university to be hired over the next five years. One of the thrust areas endorsed by E&E Institute's engineering task force was also identified as nuclear power generation. In addition to having strong departmental support, the nuclear engineering field has strong endorsement university-wide. Because of their strong commitment, E&E Institute has agreed to provide a large fraction of our proposal's matching costs.

Collaboration on research and teaching is an important component to retaining successful faculty. Given the size and breadth of expertise, numerous opportunities exist at the university for a new faculty member to collaborate. Current nuclear engineering faculty working on thermal-hydraulics, reactor safety, and on core modeling will be obvious collaborators. We are aware of other opportunities for multi-disciplinary collaboration with Department of Mathematics and Department of Physics within the BLANK College of Science; with the Engineering Science and Mechanics Department within the College of Engineering as well as with the Department of Material Science within the College of Earth and Mineral Sciences. Because of the impact of public opinion and public policy on nuclear power related decisions, we envision collaboration of the new faculty member with the Science, Society, and Technology Program and other faculty associated with government policy. Our current nuclear engineering faculty members have existing synergies between the NE department and these departments through both research

and teaching collaborations. It is envisioned that jointly taught courses and interdisciplinary research collaboration will be developed through the interactions of the new faculty in advanced nuclear power technologies.

It is through the support of these efforts that a strong nuclear engineering program will be sustained at the university. As such, the new faculty hire will have an ideal academic environment in which to thrive.

Example #2

INSTITUTIONAL SUPPORT

Here, we summarize these forms of institutional support:

• In the past 5 years, the President and Board of Trustees provided the School of Engineering with fully funded faculty slots and fully budgeted start-up funds to attract the best candidates available in order to grow SOE and NE to a size appropriate of the rank and reputation articulated in the university plan. The successful implementation of the plan is shown in the recent hiring of the several junior faculty in the Nuclear Program.
• It should not be under appreciated that our President is fully committed to an excellent and thriving NE Program.
• As with the President, the Dean of Engineering has committed efforts and resources in the growth of the NE Program.
• The Dean convened an NE External Advisory Panel to help with defining a vision and roadmap for a strong and compelling NE Program.
• The Dean has committed the use of an endowed professorship as a mechanism for attracting much needed senior leadership to the NE Program.

Recognizing the critical importance of NE, we have aggressively identified and hired five new NE faculty in the past three years.
• The singular focus over the past three years has been the revitalization of NE. In doing so, there has been significant commitment of NE resources to grow and revitalize NE.
• The Department Head has solicited meetings with State and industry officials as part of strategic planning for revitalization and refocusing of major facilities.
• In general, the Department Head has instituted support and mentoring mechanisms for junior faculty (including preparation of this proposal).

This is not an exhaustive list of the actions and resources in place to directly or indirectly support the revitalization of NE at the university. However, it does accurately portray the broad institutional commitment at all levels from program to President to rebuilding Nuclear Engineering at the university. We feel very strongly, therefore, that our vision and strategy directly aligns with the goals of the NRC Faculty Development Program. We respectfully request, therefore, full funding of this grant proposal.

Example #3

SUSTAINABILITY

The university has about five faculty members who have degrees in Nuclear Engineering and has plans to start a Nuclear Engineering Bachelor's degree program. Some courses from the Nuclear Engineering curriculum are being taught at some Engineering Departments such as the

Department of Electrical and Computer Engineering and Computer Science. In addition, the university is in the process of developing a mentor protégé program with Y-12 Partner #2. This partnership is facilitated through Partner #1, of which the university is an associated member. The program will involve admitting students to Y-12 for internships, co-op, and full time employment. Due to the "baby-boomers" retirement, Y-12 Complex is in dire need for a young and diverse workforce capable of supporting the design, construction, operation, and regulation of nuclear facilities and the safe handling of nuclear materials. The support of this fellowship will build the foundations to sustain a pipeline of such workforce from the university to Y-12 Complex. Furthermore, the established collaboration with Partner #3 and Partner #1 enables us to sustain such program to better serve our sub-privileged students and increase diversity in nuclear science, engineering and related disciplines.

Innovation - Partnerships/Consortia/Minority institutions/Distance Learning, etc. Criteria #5 ($15M) – Four Examples

Example #1

We plan to target a number of regional and minority-serving institutions where we maintain close contacts and collaborations. We maintain strong ties with an HBCU, where we have assisted in the development of a radiochemistry program. Students and faculty members from various HBCU's have attended summer research programs at our university.

The fellowship program will be used to explore and develop future consortia and partnerships with other institutions including post-secondary MSI's. This may be accomplished by hosting course sessions for courses dealing with nuclear and radiological studies at MSI's.

Example #2

We maintain a strong relationship with the other Big BLANK nuclear engineering programs, for sharing of various educational and research facilities. We plan to continue these relationships in the future.

Example #3

One unique component of this application is the fact that this fellowship program will be made available to students via distance learning. This would enable our program to tap into a significantly larger pool of candidates, including professionals within the US government or nuclear industry; such as the US NRC, US DOE, fuel vendors, utilities, and national laboratories. In other words, students enrolled in this program need not be physically at the university, but they would be part of our graduate program from wherever their home base happens to be.

The department's ties with industry have provided opportunities for students to implement and evaluate new technology in a real-world environment. These projects have involved various utilities (name of utilities) and DOE laboratories. Students in the nuclear engineering department have the opportunity to work on projects sponsored by the Maintenance and Reliability Center and the Waste Management Research and Education Center. These centers

are interdisciplinary research organizations that sponsor major research programs throughout the university.

We have had students spend at least one semester or summer at Los Alamos, Oak Ridge, Sandia, Pacific Northwest, Idaho, and Brookhaven National Laboratories and the National Institute of Standards and Technology. In some cases the student was sponsored by lab-originated contracts, in others by grants where a cooperative agreement was reached to further mutual research objectives, in yet others the student was hired directly by the lab as a graduate research assistant.

Example #4

Our research reactor serves as a magnificent resource for students, for both research and training. Our close ties and collaboration with local power plants is another resource for hands-on training of our NRC Fellows.

Leveraged/Matching Funds Criteria #6 ($15M) – Four Examples

Example #1

The department will commit matching funds to the fellowship program.

The university cost share will be distributed over the four years of the project. It will be provided by funds made available by the mechanical engineering department. The amount of $1,000 per year per student is allocated for travel. The remainder is to be spent to provide each awardee with a state-of-the-art tablet PC at the beginning of his/her studies.

Example #2

Several non-federal (industry) sponsors have committed cash contributions to support this program, McCallum Turner, AREVA and USEC will contribute $12,000, $5,000 and $3,000 respectively. Certificates or letters indicating the commitments from these industry partners are attached. These grants are designed to be complementary to the NRC funds enhancing nuclear engineering education and research.

Example #3

The university is committed to attracting top talent and will provide $9,000 per year to the Ph.D.-level Fellow. Therefore, the Ph.D. Fellow will receive a substantial salary. These stipends comfortably exceed the average paid to mechanical engineering graduate assistants at 30 large research universities.

Conference and research-related travel will be an important component of the Fellows' professional development. Exelon, Inc. has provided a gift to support Fellowship and Scholarship awards. Half of this gift will be used to pay at least one travel item per year for each Fellow. Fellow travel may include conference attendance or a site visit to a research collaborator in industry, the national laboratory complex, or the NRC.

The participation of in-state nuclear organizations will be leveraged to extend the educational opportunities under this project. Experiential learning, such as plant tours, and guest lectures, which typically include travel costs, will be made possible to graduate fellow recipients by the organizations.

Example #4

The university supplied examples of commitment letters.

Quality of Faculty Criteria #7 ($15M) – Two Examples

Example #1

Ideally, we want to attract a post-doctoral researcher who has had three to five years of experience in the nuclear industry or a DOE national laboratory. He/she will have a degree in nuclear engineering or a closely-related field applied toward nuclear engineering. In particular, we seek someone with a strong foundation across the spectrum in nuclear engineering to teach courses, but will look for research interests in areas of national importance such as reactor physics, reactor thermal hydraulics, nuclear forensics, fuel reprocessing, nuclear environmental engineering, etc. We also desire someone who has experience writing proposals and bringing in research funds, who can attract students and post-docs, who has a good publishing record, and who has an established network of connections within national labs, academia and government. In other words, we want at least one assistant professor who will not have a steep learning curve and in whom we will be confident of successfully achieving tenure. Furthermore, as we are still growing our program, we would expect this individual to be proactive in new course and curriculum development after the first year.

While the goal is to recruit an experienced candidate, exceptional candidates graduating directly from a university will be considered. Given that we would like to hire two assistant professors, it is expected that one of the candidates will fall into this latter category. We would also consider an exceptional person who is currently an Assistant Professor with two to four years of experience at another university. However, the goal should be to bring in new faculty to academia instead of just transfers from within. Finally, we will try to recruit an experienced person from the nuclear industry or someone who has operational experience at the Associate Professor level. The reason for the Associate Professor level is to be able to offer an attractive salary commensurate with current experience and current pay levels. They would be hired at the untenured level in a probationary tenure track position. Such a person would have less of a learning curve, have an established network of contacts in industry, and be able to bring their experience into the classroom to the students. This is the fastest way to put the nuclear engineering program on a solid foundation for further growth and success.

Additionally, the university has a strong commitment to the principle of diversity and, in that spirit, seeks a broad spectrum of candidates including women, minorities, and people with disabilities. The university is a recipient of the National Science Foundation's Institutional Transformation Award. Elements include advancing women into faculty careers, increasing the representation of women, and empowering women as leaders and scholars. Any women hired as new faculty under this proposal will be connected to the BLANK program.

As usual, a search committee will be established for the recruitment of this position. The committee will consist of members of the Mechanical Engineering department with at least one person from outside the department. There are quite a few faculty with background or degrees in nuclear engineering. We will draw on them as much as possible to make up the search committee. A national recruitment effort will be made to find candidates who are U.S. citizens or non-citizen nationals, or individuals lawfully admitted for permanent residence, who hold a professional doctoral degree or its equivalent. This will involve advertising through the ANS Nuclear News,
the ANS Career Center, the ANS Faculty Advisors of Student Sections Listserv, the Chronicle of Higher Education, the Nuclear Engineering Department Heads Organization (NEDHO), ASME's Mechanical Engineering magazine, the ASME Job Board, the
ASME Nuclear Engineering Technical Division, and at various national ANS meetings and topical meetings. The recruitment ads will emphasize that these are NRC Faculty Development positions and that they will get much more guaranteed support than the typical new hire would otherwise receive. In fact, taking such a position would practically guarantee a world-class successful career and attainment of tenure assuming the individual puts in the required level of effort expected.

Example #2

Faculty hiring and subsequent tenure and promotions are arguably the most important functions in the life of a university department. The decisions made during these processes permanently affect the lives not only of the individual faculty members, but of the university and all of the students with whom those faculty interact. In general, faculty hiring within the nuclear program is done subject to the following principles:

- Excellence: An organization is only as good as its people. We must therefore strive to identify the very best individuals.
- Commitment: If we are wise in our hiring decisions, we must also be committed to the long-term success of our faculty; we must be committed to seeing them through tenure and all promotions.
- Investment: It is incumbent upon the department and university to provide whatever resources possible to provide its faculty the greatest chance of success.
- Value and respect: Every individual brings unique gifts and talents to an organization.

Within this context, there are a number of criteria for selection of our faculty.

Expressed specifically in terms of the nuclear engineering program. We continually seek the successful faculty candidate who has:

- Foundational expertise in an area of importance to nuclear engineering with the flexibility and desire to contribute to and ultimately lead existing and future thrust areas.
- Excellent credentials including education, research, publications, references, etc.
- Strong communication skills for both teaching as well as engaging in critical research, development and technology communities.
- A positive and engaging personality in order to enhance a mutually satisfying and supportive community.

The two faculty members identified to be supported under this grant meet all of the criteria identified above. Professor BLANK joined the faculty 2008 as a tenure-track assistant professor in NE. He is an expert in BLANK and BLANK. He has been working on the development of BLANK for BLANK over 10 years, and has been recognized as a young leading scientist in

these fields. His research has been supported mainly by DOE and currently he is serving as a co-PI studying materials behavior under extreme irradiation and high temperature environment encountered in reactor, accelerator and repository conditions. Since joining the university he has been actively teaming up with several colleagues in developing research and education programs in materials for nuclear engineering applications. His primary research interests are: 1) BLANK and 2) BLANK.

Professor BLANK (#2) joined the faculty in 2006 as a tenure-track assistant professor. She is an expert in BLANK and BLANK and has been very prominent in these fields (brief description of the ongoing and past research work). Additionally, she has strong interests in studying the behavior of materials in highly corrosive environment (longer explanation here). The efforts are extremely important for understanding material behaviors when utilized as waste forms for actinides and fission products immobilization. Her research will also provide the theoretical basis for nuclear materials design and fabrication.

Consistent with the principles of commitment and investment, each of the two targeted recipients (and indeed all faculty hires) have been provided with highly competitive start-up packages.

The package for each targeted recipient includes:

- Competitive salary and benefits package, two months summer salary for two years (for a total of four months)
- two years of graduate research student support for two years (for a total of four years) including funding for summer support
- a generous research account that provides funding for equipment, travel and other research expenses that the individual may use over the first three years of her/his appointment.

Curriculum Development Program ($5M) – Criteria and Examples

Supporting Nuclear Educational Infrastructure & Fields Critical to NRC's Regulatory Mission Criteria #1 ($5M) – Two Examples

Example #1

BLANK offers degrees in 130 programs, through 12 academic schools. Students can take courses toward a graduate degree, certificate, or for personal enrichment, among 41 doctoral programs and 111 master programs. BLANK has long been committed to teaching nuclear science and nuclear engineering. BLANK has been involved in many areas of interest and importance in the BLANK arena. This proposal would allow us to leverage that expertise to develop an associated teaching program that BLANK professionals are eager to see mature. With joint appointments in academic departments, many staff members are already teaching courses in physics, chemistry, or engineering. With the creation of this Master's program, the courses to be offered will be derived directly from our specific expertise and research interests,

which is a unique combination found in no other academic setting, while addressing a National need to rebuild the general educational infrastructure in the nuclear field.

The expertise in the field of BLANK is very well represented at BLANK. This first-hand expertise is an important strength of the educational program that we are proposing, which will essentially provide "full-immersion" to ongoing real-life research and development programs in the nuclear field. Our technology center environment facilitates close relationships between teachers, scientists, and students and can provide multiple applied study cases and a unique opportunity for experiential learning. Staff includes many internationally recognized experts in the field of BLANK who are eager to share their knowledge through this new Master's program. The program is designed to emphasize experiential learning. It will be taught by professionals who are experts that are highly involved in research in this field. The practical applications that students will learn of in this program will be taught in the midst of R&D conducted for the nuclear industry. The importance of this aspect is further emphasized by the requirement of a final research project.

A unique series of long-term BLANK tests have been initiated with many ongoing for nearly thirty years. This unique data set has been the source of close collaborations with our counterpart in COUNTRY to research the complex issue of BLANK. This and other international collaborations would provide obvious bases for internships for students interested in a degree in BLANK. The research conducted at BLANK in the field of BLANK has earned consistent, very positive feedback from its DOE and nuclear industry clients. Technologies developed at [university name] have been successfully licensed and employed in the nuclear industry. It is fully expected that further teaching material development will be undertaken as the program develops to most effectively meet student needs and the evolving requirements of the nuclear industry.

Example #2

This proposal will improve the educational infrastructure in BLANK at [university name] by: (1) improving curriculum through creation of two new courses and (2) by allowing for the inclusion of necessary laboratory instruction through the acquisition of [descriptive] equipment and an essential neutron source.

The continued and expanded utilization of nuclear energy is inevitable as the United States prepares to address looming energy deficits. BLANK is one of many technical fields essential to the safe, effective use of nuclear energy. An aging and retiring workforce has created a critical shortage of current and future [occupation]. Plans for new nuclear power plant construction will only serve to increase the demand for quality, workforce-ready graduates of the BLANK program. The work proposed here will improve the educational infrastructure at the largest BLANK program in the [geographical location], thereby assisting in improving the quality and quantity of future [occupation] in the United States.

The enrollment in the BLANK major at [university name] has increased dramatically over the last eight years. Enrollment numbers rank favorably with other undergraduate programs in the United States. Each BLANK major at BLANK is required to complete at least one summer internship, many of which are conducted at NRC-licensed facilities. This internship complements the classroom experience and, in particular, makes upper-level classes take on a whole new meaning for students, who are then able to relate classroom concepts with what they have participated in at the facilities where they performed their internships. The current proposal

effort would help bring the academic BLANK program at BLANK even closer to what the students experience in the workplace.

BLANK has a history of success in producing graduates that have gone on to work in a variety of nuclear energy related positions including: nuclear power reactors, U.S. Department of Energy facilities (Oak Ridge and Savannah River Site (SRS)), regulatory agencies, and consulting work (including work on the Yucca Mountain Repository).

Upon completion of the course students will be:

• trained to work safely in the BLANK nuclear laboratory;
• better prepared to participate in summer internships in the nuclear industry;
• and better able to identify with their chosen major and future career.

The latter point will hopefully lead to better retention of students in the major, and may lead to BLANK majors being more effective in the recruitment of new students into the area of BLANK.

Proposed Approach and Collaborative Linkages Criteria #2 ($5M) – Two Examples

Example #1

The four courses modules proposed for this project will constitute a focus area of study for engineering, construction and industrial technology study. Material developed for these four modules will be offered through a range of delivery channels each addressing the knowledge requirements of a different audience. The first two modules of the program proposed for design and delivery under the U.S. Nuclear Regulatory Commission Nuclear Education Grant, Fiscal 2009 Announcement are: BLANK and BLANK.

Five presently existing channels will be used to deliver some or all of the four course modules. These channels are: 1) advanced technical electives in the B.S. in Engineering program; 2) technical electives in the M.S. in Construction Management graduate program; 3) technical electives in the B.S. in Industrial Technology program; 4) modules in the Environmental, Occupational Safety and Health Certificate Program (hazardous material safety track) and 5) as on-line courses available nationally through BLANK. The B.S. in Industrial Technology as well as the Occupational Safety and Health Certificate Program are offered through the university's School of Continuing Studies. Depending on the delivery channel for each course, material content and course numbering may be adjusted to address the specific needs and competencies of each audience. In addition, as the newly established minor in Nuclear Engineering is further developed and, in conjunction with BLANK new channels for course delivery, collaborative partnerships will be further developed. Since the proposed program described here is entirely complementary to BLANK minor in Nuclear Engineering program, the synergistic strength of both programs together will more fully serve all students, professionals and the industry.

Example #2

The health physics program has a long history of successful and meaningful partnership with a number of regional nuclear industry entities. As mentioned previously, all students are required

to participate in at least one summer internship. These internships take place at nuclear facilities. These paid internships are successful due to the energy and commitment that the host facility puts into the program. These industry partners have also made numerous trips to the campus for the purpose of recruiting students to work for them as well as recruiting non-majors. A summary of these partners follows.

BLANK is perhaps the partner with the longest history of collaboration with BLANK. Dating back to the inception of the program, the nuclear power plant has had students as summer interns. In 2007 the partnership expanded to include BLANK nuclear power plant, which has taken two interns each of the past two summers. Both the BLANK and the BLANK have BLANK alumni in management positions. In the spring of 2008, management from both facilities as well as corporate headquarters sponsored BLANK Day at BLANK. The event targeted approximately 50 undergraduate students interested in the science and engineering disciplines and introduced them to the health physics discipline.

Institutional Capability and Capacity Building Criteria #3 ($5M) – One Example

Example #1

As demonstrated in the prior sections of this proposal, the health physics program has a long history of excellence in undergraduate health physics education. The institution possesses the necessary faculty, students, industrial partners, laboratories, and equipment to successfully implement the course development in this proposal. The Department is comprised of eight faculty members. Three of those faculty members principally support the health physics program. In addition to Drs. BLANK and BLANK is a nuclear physicist and he is chair of the department and professor of Physics. While not directly involved in this proposal, BLANK has already played a supportive role in the course development and grant proposal process.

The facilities on the campus, and specifically in the Department, are more than adequate for carrying out undergraduate teaching and research laboratories. While the department has multiple introductory teaching laboratories, a Modern Physics Laboratory, and an Electronics Laboratory, the Nuclear Science Laboratory is the facility of importance to this proposal. The Nuclear Science Laboratory contains the radiation detection equipment and sources used in the upper-level health physics courses. It serves as a host for both instructional and research purposes. Current major equipment and sources are summarized in the following table. Less significant sources and supplies have been omitted from the table. The Department possesses and maintains a radioactive materials license for the safe and legal possession and use of licensed radioactive materials.

Key Personnel Criteria #4 ($5M) – One Example

Example #1

The PI and co-PI have years of experience in nuclear and radiochemistry teaching and research, neutron sources, nuclear materials detection and radiation detectors, and applications

of nuclear methods in science and technology. The PI, Dr. BLANK, is a professor of Nuclear Engineering at the Department of Mechanical and Nuclear Engineering and Director of the Radiation Science and Engineering Center at BLANK. He has extensive teaching and research experience (more than 20 years) in radiation measurements, neutron activation analysis, cold neutrons and prompt gamma activation analysis, neutron beam design and applications and neutron depth profiling. The co-PI, Dr. BLANK, is the professor of Mechanical and Nuclear Engineering and Program Chair of Nuclear Engineering at [university name]. He has been an active scholar for over 25 years in the areas of radiation detection, neutron radiography, neutron activation analysis and other nondestructive testing techniques

Budget Criteria #5 ($5M) – One Example

The budget should be reasonable for the work that is being proposed, and should be detailed. Although not part of the critieria, the below information provides you with the necessary information and guidance for a proper budget narrative as part of your proposal.

Detailed Budget Justification: All applications must have a detailed budget narrative explaining and justifying the federal and nonfederal expenditures by object class category as listed on SF-424A, Section B (Budget Category). For clarification and simplicity, it is best to discuss each expense by object class in the order that they appear on the SF424A. Include the dollar amounts in the discussion and how the dollar amounts were derived. Include detailed descriptions of all cost justifications (see below for more detail). Additionally, provide any cost sharing or matching cost details. Separate budgets within the single proposal must be provided if more than one funding action is anticipated (e.g., if funds are to be allocated to more than one institution or agency through subcontracts).

The budget narrative submitted with the application must match the dollar amounts on all required forms. Please explain each calculation and provide a narrative that supports each budget category. (In other words, Block 15 on the SF-424 must equal total costs identified on the Budget Information SF-424A form, which must match the budget narrative).

Personnel:
a. Include salary and wages (fringe benefits are listed separately).
b. Provide breakdown of personnel by classification (i.e., job title).
c. Identify key investigators (if applicable).
d. State time commitments in hours or percent of time for each person or position
e. List total charges for each person or position with calculations of costs as Federal or non-federal.
f. All personnel costs must be allowable in accordance with OMB Circular A.21: Cost Principles for Educational Institutions.
g. Explain any special considerations.

Fringe Benefits:
a. Identify separately from salaries and wages.
b. Provide description of benefits received by personnel when the fringe rate is more than 35% of the associated salary.
c. Ensure the fringe benefits are charged to Federal and nonfederal (matching/cost share) categories in the same proportion as salaries.
d. Do not charge under another cost category any costs that are included within the

fringe rate or indirect costs.

Travel: Provide breakdown of travel costs as follows:
a. Destination
b. Estimated costs and type of transportation
c. Number of travelers and related lodging and subsistence (per diem costs)
d. Brief description of the travel involved, its purpose, and explanation of how the proposed travel is necessary for successful completion of the project.

Other travel considerations:

- If travel details are unknown, then the basis for proposed costs should be explained (i.e., historical information) - do not "pull numbers out of the air" or list a lump sum estimate.
- Travel costs can be charged on an actual basis, on a per diem or mileage basis in lieu of actual costs incurred, or a combination of the two if applied consistently and results in reasonable charges.
- Remember "Fly America Act."
- Limits the use of foreign flag carriers to foreign travel.
- Waiver only allowed for specific instances and will require prior approval.

Equipment:
a. "Equipment" is nonexpendable, tangible personal property with a unit cost of $5,000 or more having a useful life of more than one year, unless determined otherwise by recipient's internal policy.
b. Items that do not meet the "equipment" definition can be included under supplies.
c. List each piece of equipment to be purchased and provide description of how it will be used in the project.
d. Budget narrative should explain why the equipment is necessary for successful completion of the project.
e. General use equipment (i.e., computers, faxes, etc.) must be used 100% for the proposed project if charged directly to the grant.

Supplies:
a. Explanation necessary for supplies costing more than $5,000, or five percent of the award, whichever is greater.
b. Requirements for supplies which exceed thresholds:
    - Explain the type of supplies to be purchased, or the nature of the expense in the budget narrative;
    - Provide a breakdown of supplies by quantity and cost per unit if known;
    - Indicate basis for estimate of supplies (i.e., historical use on similar projects).

Contractual:
a. Treat each contract or sub grant as a separate item.
b. Describe products or services to be obtained and indicate the applicability or necessity of each to the project.
c. Provide separate budgets for each sub grant or contract, regardless of the dollar value and indicate the basis for the cost estimates in the narrative.
d. List all grant or contract costs under the Contractual Line Item on the SF 424-A.
    - Example - do not incorporate a grantee's indirect costs under the indirect

costs line item for the applicant/grantee.

Other:

a. List items by type of material or nature of expense.
b. Break down total costs by quantity and cost per unit, if applicable.
c. State the necessity of other costs for successful completion of the project.
d. Exclude unallowable costs in accordance with OMB Circular A.21: "Cost Principles for Educational Institutions," examples include:
   - Alcohol
   - Contingency
   - Entertainment
   - Fund Raising.

<u>Note</u>: Project Sustainability is not a criterion that gets rated, but it must be included in your application per our announcement. Below is an example of a sustainability narrative:

Several elements will ensure the sustainability of our program. First, there is an institutional commitment to revive the Nuclear Engineering education and research at [university name] as part of the strategic plan of the School of Engineering and Applied Science and through the Center for Energy Science and Technology Advanced Research.

Sustainability of the proposed program will be further ensured by commitment not only at the School level but also at the Mechanical and Aerospace (MAE) Department level. Indeed, as part of the strategic plan of the MAE Department, at least two FTE positions have been allocated to revive the Nuclear Engineering Program as discussed in BLANK. In addition, the long-term agreement with BLANK for providing ½ FTE for a ladder faculty position in the MAE Department (the other half coming from the school) also demonstrates that the proposed project will be sustained for years to come.

In addition, BLANK started an online program in 2007. After two years, the program is already financially sustainable and enrollment growth is expected in the coming five years. A new program in Energy and in Nuclear Engineering should be added given the societal needs in non-greenhouse gas emission technology. Overall, the potential funding of the proposed project by the US NRC will come at a critical time in the MAE Department history as all actors and elements are gathered to revive of the Nuclear Engineering Program but are faced with significant reduction in State funding.