

LAC REVIEW OF WARD CENTER

EXECUTIVE SUMMARY

On September 15th, 2000, Vice Provost for Research, Professor Robert R. Richardson, asked the Local Advisory Committee (LAC) to review Ward Center and make a recommendation to him about its future. The findings of the LAC are:

1. The LAC found no evidence for major safety concerns at Ward Center.
2. At the present time Cornell University does not have a substantial academic or research presence in the area of nuclear (fission) engineering.
3. No compelling case has been found for a strong connection between the existence of the Ward reactor on the Cornell campus and any role Cornell might play in a possible future resurgence in the field of nuclear power engineering.
4. Reactors are being closed around the country for cost and programmatic reasons, even in Universities with active nuclear science and engineering departments.
5. The cost of continuing the operation of the Ward Center was clearly a major motivation for the initiation of this LAC review, as was the mandate from the Faculty Senate that such a review be conducted two years after establishing this University research center. However the LAC only turned to consideration of these costs after first attempting to evaluate the impact of the reactor, both current and potential, on university research and academic programs.
6. Given the absence of a significant Cornell academic program in nuclear engineering, as discussed in (2) above, the justification for the support and continuation of the Ward Center for Nuclear Science must be principally based on it serving effectively as an university-wide user facility. Taken in total, the evidence reviewed by the LAC does not indicate that the TRIGA reactor is having an important, major impact as a user facility for the Cornell community, either in research or in academics, that is proportionate with the overall cost of maintaining and operating Ward Center. Neither does the evidence indicate that the reactor is likely to be able to have such an impact in the future.
7. There appears to be a substantial, cost-effective benefit to continuing the operation of the Co⁶⁰ source, independent of the decision on the TRIGA reactor and the future of the Ward Center.

The LAC unanimously recommends that Cornell move to decommission the TRIGA reactor and phase out the Ward Center activities. We recommend that the administration be proactive in addressing the transitional inconvenience of current users as they transfer their research to other facilities, and in helping the staff whose jobs will be affected. The LAC recommends that Cornell maintain the Co⁶⁰ source at an appropriate local facility. These recommendations are independent of any proposed schedule for fuel removal from the reactor.

Charge to LAC on the review of the Ward Laboratory:

On September 15th, 2000, Vice Provost for Research, Professor Robert R. Richardson, made the following request to the Local Advisory Committee (LAC), whose members are listed in Appendix A.

I request that the LAC examine Ward Laboratory and make a recommendation to me about its future. There are two reasons for this review. The first is that the original Faculty Senate resolution about Ward Laboratory in 1996 requested a review of the laboratory in the academic year 1998-99. We are two years late in responding to that request. The second reason is that the re-licensing of the reactor by the NRC is scheduled for the academic year 2002-03. Cornell must make a decision about continuing the operation of the reactor before that time. Therefore, the advice of the LAC is needed on the question of whether the Laboratory should continue as a center supported by the university. It would be most helpful if the LAC gave the recommendation before the end of the current academic semester.

The decision should be made on the basis of what is in the best long term interest of Cornell. There are a number of considerations which include: 1) the current and potential future faculty involvement in the research programs of the center; 2) the role the center plays in graduate and undergraduate training; 3) the costs of the center to the university; 4) the value of the center as a service facility balanced against other potential uses of the building and space it occupies; and 5) the potential need for and costs of upgrading and maintaining the facility. In reaching its conclusions the committee is encouraged to consider any other questions which the LAC decides to be significant.

Process:

The first phase in reviewing Ward Center was to gather information from the Cornell community and the community of users of the Center. This information-gathering took several forms:

- Dr. Kenan Unlu, Director of Ward Center of Nuclear Science and Adjunct Professor of Materials Science and Engineering, met with the LAC for approximately 90 minutes and described the center's activities and research program, both current and future.
- Professors Peter Kuniholm, Robert Kay, Norm Scott, and Val Kostroun met individually with the full LAC for 30 – 60 minutes each.
- The entire LAC visited Ward Center and had a tour from Dr. Unlu who described the ongoing projects and future potential projects utilizing the reactor.
- John Silcox, Vice Provost for Physical Sciences and Engineering, and Jack Lowe, Executive Vice Provost for Research, briefed the LAC on the current operating costs for the Center and the financial implications of closure versus continued operation.

- Members of the LAC met individually with approximately 30 faculty members across campus who had been listed as users or potential users of Ward Center. In addition attempts were made to contact anyone who had indicated in the 1996 report, A Plan for the Future Operations of Ward Laboratory, Cornell University, that Ward Center was either 'important' or 'very important' to their research. The interviews lasted up to an hour. The persons interviewed are given in Appendix B. The list of questions that each member of the LAC used to guide the discussions in the interviews is given in Appendix C. The results of the one-on-one interviews were reported to the full LAC.
- Dr. Unlu solicited letters to the LAC from a wide variety of users of Ward Center. In addition to receiving letters from members of the Cornell Community, we received letters from the directors of other campus reactor facilities, the DOE, and a significant number of industrial users of the center. A list of the letter writers is given in Appendix D.
- On December 20, DOE officials William Magwood IV, Director of Office of Nuclear Energy, Science and Technology, and John Gutteridge, Director of University Programs, came to Cornell and met with three members of the LAC for 45 minutes.
- A significant amount of written information detailing the scientific work at Ward Center was provided to and read by the committee. The committee was provided with a detailed description of usage, information about the history of the center including the report A Plan for the Future Operations of Ward Laboratory, Cornell University, written in February, 1996 by the Ward Laboratory Advisory Board (Executive Committee members: Professors James Burlitch, Donald Holcomb, Robert Kay), and data on the graduate field of Nuclear Science and Engineering (NS&E).

The information-gathering phase of the process lasted from mid-September through the end of December. The discussion of the LAC's findings did not begin until December when the bulk of the information had been obtained.

In December, the LAC began to discuss criteria for making a recommendation to the Vice Provost, and what the substance of that recommendation would be. This document, including the final recommendation on the future of Ward Center, was forwarded to the Vice Provost on February 6, 2001.

Summary of Ward Center and Activities

The mission of the Ward Center for Nuclear Science, as described by the 1996 report A Plan for the Future Operations of Ward Laboratory, Cornell University that resulted in the establishment of this University Research Center, is "[to provide] nuclear analytical and testing" services to the campus community, and to outside academic and corporate users. The Center has two general capabilities, the first being the TRIGA nuclear fission reactor that can operate at 500 kW thermal power and the second being a Co⁶⁰ gamma radiation cell. (A third capability, the Zero Power Reactor (ZPR) which previously had been employed mainly as an educational and training facility for students in the Nuclear Science and Engineering program, was recently shut down and its fuel removed from campus. The ZPR now is in the final stage of being officially decommissioned by the University.)

Of the two capabilities, the gamma cell has had the more widespread usage by the Cornell community in recent years. According to statistics provided by the Ward Center administration, in fiscal year 2000 the gamma source was utilized a total of 153 times for a total source usage of 1586 hours. Cornell research groups were responsible for approximately 74% of this usage, with these groups coming from seven different Cornell units. Of these, the Department of Soil, Crops, & Atmospheric Sciences was the largest user in FY 2000 (23%).

The principal current function of the Ward nuclear reactor is to provide neutrons that can be utilized in analytical and related studies. The most widely used application is neutron activation analysis (NAA) where a sample of material is sent into the core of the reactor, irradiated with neutrons, and then removed. The energy distribution and intensity of the gamma rays that are emitted by the activated nuclei are then measured to provide a highly sensitive, quantitative analysis of the sample's elemental composition.

In addition to the NAA technique, neutrons can be emitted from the reactor core, through one of seven beam ports, and potentially could be employed in activation and scattering experiments. These neutron beams can be used in a variety of ways, including the neutron depth profiling of thin film materials, the analysis of samples (such as works of art) by neutron radiography, and the "prompt gamma" neutron activation analysis, with the use of a cooled neutron beam of samples containing isotopes with very short activation half-lives that are not suitable for standard NAA measurements. Of these beam techniques, only the radiography is currently operational, while the neutron depth profiling capability is apparently almost operational. The neutron beams could also be used for clinical studies of any therapeutic effect of boron neutron capture on certain types of cancers although this has not yet been attempted at Cornell. While boron neutron capture therapy has received some considerable attention nationally over the years from the radiation medicine research community, at this point it apparently is not currently being actively pursued elsewhere, although that situation may be temporary.

In FY 2000 the nuclear reactor was utilized for a total of 463.4 hours with members of the Cornell community being responsible for 41.5% of this usage. The remainder of the reactor utilization was by industrial users, principally for the purposes of detector calibrations and materials irradiation. This level of reactor operation is 10 to 20% above the average of the past 15 years. With respect to the Cornell users, in FY 2000 they came from five different units, with faculty from Geological Sciences being the most active, and responsible for 70 hours of reactor utilization .

Faculty and Administration Input Through Interviews:

This section summarizes the comments that we heard from the Cornell faculty and administration during the information-gathering phase of the review. A spectrum of views, some contradicting others, was expressed.

- The staff of Ward Laboratory was universally praised for its technical knowledge and its helpfulness in carrying out experiments.
- Several faculty felt that the Ward administration was more pro-active during the last few years in seeking new funding and attracting additional collaborations than previously. They believed that Kenan Unlu was doing the job envisioned by the 1996 report.
- Safety: Some individuals had concerns about safety and especially the longevity of the TRIGA reactor, given the age of the facility. Those most knowledgeable about the

reactor have fewer worries. The control system is the biggest concern, chiefly due to pending replacement cost rather than safety, because it is the most outdated.

- Research. Little competitively reviewed, externally funded research has been done with the reactor for years. Much of the work, especially that for outside industry, is routine. Since the inauguration of Ward Center in 1996, its research base has grown somewhat across campus, and signs for the future are generally positive. Many people across campus have good impressions about the facility. On the other hand, very few if any young faculty are enthusiastic about the science, about devoting their own careers to building or improving the facility, or about utilizing the reactor heavily.
- The use of Ward by industry is appropriate for a Land-Grant college, but should not be the primary function of the facility. Some faculty expressed the sentiment that the use by industry, even in a Land-Grant college, should be in some way connected to faculty programs; this is not the case at Ward.
- The prevailing opinion expressed in the interviews was that at present, neutron activation analysis (NAA) is the technique at the reactor producing the most science. Some faculty are optimistic about potential upgrades to the facility. Other faculty interviewed felt that the prompt gamma facility is not likely to be successful, and that because of the absence of a local medical school and possible scientific uncertainties, neutron capture therapy is also unlikely to be successful at Cornell.
- In most instances other on-campus instruments could replace many of the analytical measurements being made at the reactor, although these other instruments generally have user fees. In a few cases the only alternative to measurements currently being made at Ward reactor would be to go to an off-campus reactor with similar capabilities.
- If Ward Center is closed, it will be much more inconvenient for those using NAA. The educational component for undergraduates doing research at the Center will be lost as will our ability to have Cornell undergraduates tour the reactor and be exposed to NAA demonstrations.
- Varying opinions were expressed as to whether Ward Center was the best use of the available space and financial resources of the University.
- The dissolution of the program in Nuclear Science and Engineering has led to a moribund graduate field. Without additional faculty, the reinstatement of a viable program at Cornell in Nuclear Engineering is not realistic at this time. There is disagreement whether the reinstatement of a program in Nuclear Engineering would require the TRIGA reactor to educate students in reactor engineering.
- Ward has provided a positive experience for undergraduates, in research and as a lab experiment for several courses.
- Several current users indicated that the availability of free and convenient NAA capabilities were what led them to use the technique.
- Although there was some disagreement, the prevailing opinion is that the plan to form Ward Center, laid out five years ago in the document [A Plan for the Future Operations of Ward Laboratory](#) and written by the Executive Committee of the Ward Advisory Board, was reasonable, particularly at the time it was written. But the facility has not become self-sufficient as envisioned in that report because usage remains low and local users are not charged. Little leadership has come from any tenured faculty, nor from the Engineering College administration.
- The majority of those with an opinion on the matter felt that if the facility is to be closed, sooner is better than later. It will be cheaper, safer and easier.
- The administration has told the LAC that the opportunity exists in the near future (2002 or 2003) to remove all the reactor fuel from the Cornell campus. The date is set by the ability of the Idaho National Engineering and Environmental Laboratory to receive the fuel. The administration is concerned that if this near-term opportunity is not pursued, then the next time-window for fuel removal appears to be post 2010. In a letter from the DOE to the chair of the LAC, we were informed that the DOE

believes that the Department's Idaho National Engineering and Environmental laboratory would be able to schedule fuel shipments anytime for an unspecified number of years in the future and that fuel shipment windows of opportunity should not be a determinative factor in deciding the fate of the TRIGA reactor.

- The estimated costs for decommissioning the TRIGA Reactor facility, in FY99 dollars, is \$4.01 million including 25% contingency. This estimate is based on the estimates of costs to decommission a similar reactor at the University of Illinois and is the official estimate Cornell has provided to the United States Nuclear Regulatory Commission in the University's annual financial report and updated decommissioning cost estimate. Some have cautioned the LAC that the actual costs may be much higher.
- A prevailing faculty opinion was that given likely future federal support for research, Cornell's research portfolio would not grow in the next decade. Thus, Cornell must evolve by substitution, not accretion.

Findings of the LAC

The findings of the LAC are:

1. The LAC found no evidence for major safety concerns at Ward Center. However, if operation of the reactor is to continue, the arguments favoring continued operation should be strong enough to justify continued upgrading of the facility as it ages. As an instructive example, in 1999 the reactor at Washington State University relined its leaking pool at a cost of \$350,000 and a new cooling tower/heat exchanger was built at a cost of \$150,000. If the operation of the Ward reactor continues, the benefit to the University must be able to offset comparable potential financial burdens in addition to the cost of operation.
2. At the present time Cornell University does not have a substantial academic or research presence in the area of nuclear (fission) engineering. In the mid-1990's, the College of Engineering disbanded the Nuclear Science and Engineering Program that had been in existence as a separate academic unit for approximately 20 years. This was in response to what the College administration deemed to be a sub-critical and noncompetitive position in the nuclear engineering area, particularly in terms of student enrollments and sponsored research activities. At that point the faculty members who were affiliated with this program were reassigned to other academic units within the College of Engineering. Since then, some nuclear engineering courses have continued to be taught through these other departments, but of the five NS&E faculty that constituted the line faculty of that program, only three remain and the majority of their current teaching activities are not focused on nuclear engineering instruction. The graduate field in Nuclear Science and Engineering (NS&E) is still in existence with six Field faculty, but only two are pursuing research that is concerned with fission engineering or with the use of fission products (neutrons) in their research programs. There has been an average of 0.7 Ph.D. degrees awarded per year in the field of NS&E between 1993 and 1999, and the majority of these graduates have pursued research in the plasma physics and fusion areas, not in areas that make use of the TRIGA reactor. The College of Engineering does not plan to make new faculty appointments in the nuclear science and engineering areas.
3. No compelling case has been found for a strong connection between the existence of the Ward reactor on the Cornell campus and any role Cornell might play in a possible future resurgence in the field of nuclear power engineering. If Cornell decided to play a significant educational/research role in nuclear power generation, faculty would

need to be hired in that discipline. Without such hires, the elimination of the NS&E program in the mid-90s effectively removed Cornell from competition in that area for the foreseeable future. The LAC discussed, without resolution, whether the nation's current energy woes might lead to a resurgence of interest in nuclear power. While the LAC heard arguments to the contrary from the DOE representatives, in the end the LAC concluded that the presence / absence of Ward reactor would not be strongly linked to Cornell's future, if any, in nuclear power engineering.

4. Reactors are being closed around the country even in universities with active nuclear science and engineering departments. Some universities with strong Nuclear Science and Engineering Departments do not have an on-campus reactor. In the US News and World Reports' ranking of Nuclear Engineering Departments, 4 of the top 14 departments, including 2 of the top 4 (University of Illinois at Urbana and University of California at Berkeley), do not have an active on-campus reactor. The University of Illinois reactor has been in 'safe store' since the summer of 1998 and the reactor at UC Berkeley was decommissioned over a decade ago.
5. The cost of continuing the operation of the Ward Center was clearly a major motivation for the initiation of this LAC review, as was the mandate from the Faculty Senate that such a review be conducted two years after establishing this University research center. However the LAC only turned to consideration of these costs after first attempting to evaluate the impact of the reactor, both current and potential, on university research and academic programs.

The cost to the central administration to operate Ward Center is currently approximately \$200,000 a year in direct cash subsidy, a cost that has been more or less constant for the past several years. The expectation of the Ward Advisory Board Report of 1996 that the Center could move to a position of decreased net cost to the University over a four-year phase-in period, principally by the assessment of user charges, has not been realized. This is due, it appears, to the inability or unwillingness of the user base to bear such charges in any substantial way. In addition to the direct cash subsidy, there are building maintenance and utility costs for the operation and upkeep of Ward Laboratory that are significant and should be considered, but for which the LAC has not attempted to obtain an independent numerical value. These additional costs have been estimated by Dr. Unlu in a document summarizing operating expenses and revenues for three University research reactors including Cornell, to be approximately an additional \$190,000. The opportunity cost of the building, or of the site, being, or not being, available for alternative uses over the next ten years is also a factor that has not been included in any estimates, nor is there any estimate of the contingency necessary to cover potential repairs as mentioned in finding (1). All of these costs must be considered in the decision to either decommission or re-license the reactor.

With respect to these costs, a representative of the Department of Energy has recently indicated that DOE may in the future contribute more to the operating costs of the Cornell reactor and those at other universities. The expressed motivation is that DOE is concerned about the closing of university reactors across the country and is seeking to slow or halt this trend, particularly at leading research universities. At this point there is no firm commitment regarding such possible support and no indication of the possible level of support.

Based on the experience of other universities, the estimated costs for decommissioning the TRIGA Reactor facility, in FY99 dollars, is \$4.01 million including 25% contingency. This cost will have to be paid whenever the reactor is decommissioned and will not decrease with time. Thus it should be viewed as an existing and fixed (possibly rising) expense to the University.

6. Given the absence of a significant Cornell academic program in nuclear engineering, as discussed in (2) above, the justification for the support and continuation of the Ward Center for Nuclear Science must be principally on the basis of it serving effectively as an university-wide user facility. It was for this purpose that the Ward Center was established in 1996 with its mission being “[to provide] safe nuclear analytical and testing facilities in support of the research and educational activities of faculty, staff and students at Cornell University.” Thus, in reviewing the Ward Center, the LAC focussed on the current level of user activity, the potential for long-term faculty interest in the reactor, and the potential for expanded multifunction usage. The LAC also examined to what extent the reactor facilities at Ward Center were uniquely enabling important research activities on campus, particularly those involving significant numbers of students and sponsored funding.

One noteworthy finding was that of the ten faculty members who were identified by the Ward Advisory Board Executive Committee Report in 1996 as being likely to find the reactor “highly useful”, only three actually used the reactor in FY 1999-2000. On the other hand some faculty not identified in that report have begun using the reactor, although generally only moderately. Of the current users most indicated that the lack of fees, the easy access and the helpfulness of the staff were major reasons for their use. When asked about the possibility of paying user fees, most users indicated that if the cost of use were to become significant, the research effort would probably not be pursued. One major user, and strong supporter of the facility, acknowledged that while the NAA capability that he used was important to his research, it was also a routine capability available elsewhere for a fee. He added that newer analytical techniques have been developed in recent years that were critical to cutting-edge research in his field while NAA was not.

A general theme noted by the LAC in its interviews is that, while some faculty have indeed been using the reactor, or expressed the possibility of using the reactor in the future, very few indicated that their use of the existing reactor capabilities would be substantial, or would be critical to the core of their programs. Moreover, no tenured or tenure-track faculty member expressed a willingness to expend time and energy to expand the capabilities of the reactor. Thus the LAC found that, while the routine NAA and radiography usage of the reactor is of some value, it is of limited impact and could be replaced in large part by use of alternative facilities elsewhere on and off campus, albeit at a cost. With respect to the potential of expanded neutron beam capabilities of the reactor, most of which have been in consideration or under development for quite some time, in some cases for decades, there is not an engaged and energetic group of faculty who are willing to champion and support their development. Nor can a compelling case be developed from the LAC interviews that more substantial use of the reactor will develop if these capabilities are indeed eventually established, nor that they would have a major, enabling impact on Cornell research programs.

The academic activities at Ward Lab in recent years have consisted largely of student tours, some of which include demonstrations of NAA or its use to characterize an unknown sample. In 99/00 approximately 400 students participated in such one-time tours, with students in the Eng. 150 courses and in Phys. 208 representing the majority of these students. A much smaller number of students are enrolled in courses that make more extensive, in some cases semester-long, use of the Ward Center facilities. In 99/00 these courses included NS&E 121 (11 students), NS&E 403 (13 students), NS&E 551 (3 students), and MS&E 603 (20 students). In addition, some undergraduate students have regularly been involved in REU projects that involve the Ward Center, with the greater number of these being involved with the NAA of dendrochronologically dated tree rings with Professor Kuniholm, and with REU projects with faculty associated with the Ward Center.

Taken in total, the evidence reviewed by the LAC does not indicate that the TRIGA reactor is having an important, major impact as a user facility for the Cornell community, either in research or academics, that is proportionate with the overall cost of maintaining and operating Ward Center. Neither does the evidence indicate that the reactor is likely to be able to have such an impact in the future.

7. There appears to be a substantial, cost-effective benefit to continuing the operation of the Co⁶⁰ source, independent of the decision on the TRIGA reactor and the future of the Ward Center. Over half the users at Ward Center employ the Co⁶⁰ gamma source rather than the TRIGA reactor and the gamma source is comparatively inexpensive to maintain. The possibility that this source could continue to be made available to the Cornell community, perhaps elsewhere on campus, without the additional infrastructure of Ward Center, should be very seriously examined by the Cornell administration.

Recommendation

The LAC unanimously recommends that Cornell move to decommission the TRIGA reactor and phase out the Ward Center activities. We recommend that the administration be proactive in addressing the transitional inconvenience of current users as they transfer their research to other facilities, and in helping the staff whose jobs will be affected. The LAC recommends that Cornell maintain the Co⁶⁰ source at an appropriate local facility. These recommendations are independent of any proposed schedule for fuel removal from the reactor.

Appendix A

Local Advisory Council

Members 2000-2001

Barry Carpenter
Joseph Burns

James Gossett
Susan Riha
Donald Bartel*
Dale Bauman
Persis Drell
James Thorp

Charles Walcott
Larry Walker
Robert Buhrman†

Chemistry and Chemical Biology
Theoretical and Applied Mechanics,
Astronomy
Civil and Environmental Engineering
Earth and Atmospheric Science
Mechanical and Aerospace Engineering
Animal Science
Physics (Chair F99-F00)
Electrical and Computer Engineering
(Chair S01)
Neurobiology and Behavior
Agricultural and Biological Engineering
Applied and Engineering Physics

*On sabbatical 2000

†Sabbatical replacement

Appendix B

Members of the Cornell Community Interviewed by LAC

Howard Aderhold
Ward Lab/Retired

Professor Neil Ashcroft
Physics

Professor Dieter Ast
Material Science and Engineering

Professor Dwight D. Bowman
Veterinary Medicine Microbiology & Immunization

Professor James M. Burlitch
Chemistry & Chemical Biology

Professor K. Bingham Cady
Theoretical and Applied Mechanics

Professor Geoffrey Chester
Physics

Dr. John Chiment
Math/Earth & Atmospheric Science

Professor John E. Coleman
Classics

Professor Edward J. Dubovi
Population Medicine & Diagnostic Science

Professor Bruce Ganem
Chemistry & Chemical Biology

Professor David Hammer
Electrical and Computer Engineering

Professor Donald F. Holcomb
Physics

Dean John Hopcroft
Engineering

Professor Joseph Hotchkiss
Food Science

Professor Kenneth Hover
Civil & Environmental Engineering

Professor Jean B. Hunter
Agricultural and Biological Engineering

Dean Michael Isaacson
Engineering

Professor Bryan Isacks
Earth & Atmospheric Science

Professor Francis A. Kallfelz
Clinical Science

Professor Robert Kay
Earth & Atmospheric Science

Professor Val Kostroun
Applied & Engineering Physics

Professor Peter Kuniholm
History of Art

Professor Bruce Kusse
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Professor Carlo D. Montemagno
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Professor Anil Netravali
Textiles & Apparel

Professor Sharon Kay Obendorf
Textiles & Apparel

Professor Rodney Page
Clinical Science

Professor Jean-Ives Parlange
Agricultural and Biological Engineering

Professor Clifford R. Pollock
Electrical & Computer Engineering

Franklin Robinson
Johnson Museum of Art

Professor Ferdinand Rodriguez
Chemical Engineering

Professor Norm Scott
Agriculture & Biology Engineering

Professor Al Sievers
Physics

Vice Provost John Silcox
Physical Sciences and Engineering

Professor Stanley Taft
Art

Dr. Kenan Unlu
Ward Center for Nuclear Science

Appendix C

Questions to guide Ward Center discussions:

- What do you think are the strengths and weaknesses of the Scientific program at Ward Center, especially those parts of the program that depend on the TRIGA reactor?
- What do you think are the strengths and weaknesses of the Educational program at Ward Center?
- What do you think are the strengths and weaknesses (perceived and/or actual) of the safety situation at Ward Center? Do you see any potential concerns over the next ten years?
- If Cornell wanted to restart a program in Nuclear Engineering, how crucial would the TRIGA reactor be for that effort?
- (For people doing research at Ward) Would you be doing this research if we did not have a reactor on campus? What alternatives are available to carry out your studies elsewhere?
- What criteria should we use in order make a recommendation to shut down the Ward Center program?
- What criteria should we use in order to make a recommendation that the University continue to support the Ward Center?
- Should the annual costs to Cornell of operating the Ward Center and maintaining the reactor, including potential costs of re-commissioning, be a consideration in this recommendation?
- Should the potential costs of de-commissioning the reactor be a consideration in this recommendation?

Appendix D

Persons from whom the LAC received written comments on Ward Center.

Prof. Martin Alexander

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