UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

April 27, 2007

Docket Nos. 05000097
05000157

License Nos. R-89
R-80

Charles R. Fay
Cornell University
Vice Provost for Research Administration
222 Day Hall
Ithaca, New York 14853-2801

SUBJECT: NRC COMBINED INSPECTION REPORT NOS. 05000097/2006001 and 05000157/2006001

Dear Mr. Fay:

This letter refers to the inspection conducted by the U.S. Nuclear Regulatory Commission (NRC) from October 3, 2006 through April 25, 2007, of the research reactors at Cornell University's Ward Center for Nuclear Sciences. The inspection was limited to a review of decommissioning activities authorized under NRC license Nos. R-89 and R-80. The enclosed report documents the inspection results.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel. In addition, the inspector selected archived soil samples for confirmatory gamma spectrometry analysis by the NRC's laboratory contractor. Based on the results of this inspection, no findings of significance were identified.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Mark Roberts at (610) 337-5094.

Sincerely,

/RA/

Samuel Hansell, Chief
Decommissioning Branch
Division of Nuclear Materials Safety

April 27, 2007

Docket Nos. 05000097 License Nos. R-89
05000157 R-80

Charles R. Fay
Cornell University
Vice Provost for Research Administration
222 Day Hall
Ithaca, New York 14853-2801

SUBJECT: NRC COMBINED INSPECTION REPORT NOS. 05000097/2006001 and 05000157/2006001

Dear Mr. Fay:

This letter refers to the inspection conducted by the U.S. Nuclear Regulatory Commission (NRC) from October 3, 2006 through April 25, 2007, of the research reactors at Cornell University's Ward Center for Nuclear Sciences. The inspection was limited to a review of decommissioning activities authorized under NRC license Nos. R-89 and R-80. The enclosed report documents the inspection results.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records, observed activities, and interviewed personnel. In addition, the inspector selected archived soil samples for confirmatory gamma spectrometry analysis by the NRC's laboratory contractor. Based on the results of this inspection, no findings of significance were identified.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Mark Roberts at (610) 337-5094.

Sincerely,

/RA/
Samuel Hansell, Chief
Decommissioning Branch
Division of Nuclear Materials Safety

SUNSI Review Completed: M. Roberts
DOCUMENT NAME: C:\FileNet\ML071170479.wpd
After declaring this document "An Official Agency Record" it **will** be released to the Public
To receive a copy of this document, indicate in the box: **"C"** = Copy w/o attach/encl **"E"** = Copy w/ attach/encl **"N"** = No copy

OFFICE	DNMS/RI	N	DNMS/RI	N				
NAME	MRoberts SH		SHansell					
DATE	04/25/2007		4/27/07					

Accession Number: ML071770479

Enclosure: Inspection Report Nos. 05000097/2006001
and 05000157/2006001

cc w/encl:
Dr. Joseph Burns, Vice Provost for Physical Sciences and Engineering
Cornell University
314 Day Hall
Ithaca, NY 14853-2801

Steve Byers, PE
Cornell Decommissioning Project Manager
Cornell University Environmental Compliance Offices
125 Humphreys Service Building
Ithaca, NY 14853

Thomas McGiff
Radiation Safety Officer
125 Humphreys Service Building
Ithaca, NY 14853

Test, Research, and Training Reactor Newsletter
c/o Dr. William Vernetson
Department of Nuclear Engineering Sciences
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

Robert Dansereau
NYS Department of Health
Bureau of Environmental Radiation Protection
Radioactive Materials Section - Room 530
Troy, NY 12180-2216

Barbra Youngberg
NYS Dept. of Environmental Conservation
Hazardous Waste & Radiation Management Section
625 Broadway
Albany, NY 12233-7258

John P. Spath
NYS Energy Research and Development Authority
17 Columbia Circle
Albany, NY 12203-6399

Christopher Higgins, Radiological Engineer
EnergySolutions
143 West Street
New Milford, CT 06776

Distribution w/encl:
B. Holian, DNMS
J. Kinneman, DNMS
S. Hansell, DNMS
M. Roberts, DNMS
J. Hickman, FSME
B. Watson, FSME
K. McConnell, FSME
Region I Docket Room (with concurrences)

SUNSI Review Completed: M. Roberts

DOCUMENT NAME: C:\FileNet\ML071170479.wpd
After declaring this document "An Official Agency Record" it **will** be released to the Public
To receive a copy of this document, indicate in the box: "**C**" = Copy w/o attach/encl "**E**" = Copy w/ attach/encl "**N**" = No copy

OFFICE	DNMS/RI	N	DNMS/RI	N				
NAME	MRoberts SH		SHansell					
DATE	04/25/2007		4/27/07					

U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos:	050-00097 050-00157
Report Nos:	05000097/2006-001 05000157/2006-001
License Nos:	R-89 R-80
Licensee:	Cornell University
Facility:	Ward Center for Nuclear Sciences
Location:	Ithaca, New York
Dates:	October 3, 2006 - April 25, 2007
Inspector:	Mark C. Roberts Senior Health Physicist Decommissioning Branch Division of Nuclear Materials Safety
Approved by:	Samuel Hansell Chief Decommissioning Branch Division of Nuclear Materials Safety

Enclosure

REPORT DETAILS

EXECUTIVE SUMMARY

This routine, announced inspection included on site review of various aspects of the licensee's decommissioning contractor program associated with the decommissioning of the Cornell University TRIGA and Zero Power Reactors at the Ward Center for Nuclear Sciences. Areas examined included organization and staffing, procedures and training, decommissioning activities, radiation protection program, transportation activities, and final status survey activities. The inspection included NRC confirmatory measurements and confirmatory sample analyses. The licensee's programs were directed toward the protection of public health and safety and were in compliance with NRC requirements.

Organization and Staffing

- Organization and staffing were consistent with the Decommissioning Plan (DP) and Work Plan for the facility decommissioning.

Procedures and Training

- Procedures were sufficiently detailed so that workers could perform survey activities safely and in conformance with the requirements of the Work Plan.

- Training was provided for operation of specialized equipment as necessary.

Decommissioning Activities and Radiation Protection Program

- Demolition and decontamination activities employed by the contractor were consistent with the DP and work plan.

- The contractor used appropriate controls to limit airborne releases from the facility.

- The radiation protection program was effectively implemented through: conduct of radiation surveys, process and engineering controls to limit generation of airborne activity, airborne radioactivity sampling and measurement, and monitoring radiation doses to personnel.

Transportation Activities

- The radioactive waste transportation program implemented by the licensee's contractor met regulatory requirements.

Final Status Survey (FSS) Activities

- Measurements, sampling, and analyses performed by the contractor were consistent with criteria specified in the FSS Plan.

Confirmatory Measurements

- NRC confirmatory measurements and confirmatory sample results did not identify radioactive material in excess of the criteria specified in the FSS Plan.

REPORT DETAILS

Background and Summary of Plant Status

The Cornell TRIGA Reactor (facility license R-80) and the Cornell Zero Power Reactor (ZPR) (facility license R-89) are located in the Ward Center for Nuclear Studies at Cornell University in Ithaca, New York. The two reactors have been permanently shutdown and all fuel has been removed from the facilities. During the week of November 10, 2003, fuel was removed from the TRIGA reactor facility and transferred to the Idaho National Engineering and Environmental Laboratory. On April 28, 2000, all Special Nuclear Material related to the ZPR was transferred to the Portsmouth Gaseous Diffusion Plant. Decommissioning of the Ward Center was conducted in accordance with a Decommissioning Plan (DP) approved by the Nuclear Regulatory Commission (NRC). The DP was prepared by and decommissioning activites were conducted by a contractor, EnergySolutions, LLC.

1. Organization and Staffing

a. Inspection Scope (Inspection Procedure [IP] 69002)

The inspector interviewed licensee project management and Radiation Safety Office staffs, contractor and sub-contractor staffs, and reviewed relevant documents relating to the decommissioning of the facility. Documents reviewed included:

- Decommissioning Plan for the Ward Center for Nuclear Studies at Cornell University, Revision 1, July 2003
- Work Plan for the Cornell University Ward Center for Nuclear Studies Decommissioning Project, Revision 1, May 2006
- 2005 Annual Report for Facility Licenses R-80 and R-89, dated August 3, 2005

b. Observations and Findings

Decommissioning activities at the Ward Center were primarily conducted by Cornell University's decommissioning contractor, EnergySolutions, LLC. Although Cornell contracted the decommissioning of the reactor facilities, the university maintained responsibility and oversight for the project. The inspector noted that the Vice Provost for Research Administration, representatives from the Environmental Compliance Office, and representatives from the Radiation Safety Office were cognizant of the decommissioning activities. Cornell representatives maintained direct project oversight and provided radiological support. A representative from the Radiation Safety Office reviewed work planning for each area. The inspector determined through interviews with the Radiation Safety Office and contractor staffs, that these individuals were knowledgeable of health physics practices and their duties and responsibilities within the scope of the DP.

c. Conclusions

Organization and staffing were consistent with the DP and Work Plan for the facility decommissioning.

2. Procedures and Training

a. Inspection Scope (IP 69002)

The inspector reviewed the following documents to ensure that the licensee's contractor had developed appropriate procedures for the scope of decommissioning work conducted at the facility:

- Work Plan for the Cornell University Ward Center for Nuclear Studies Decommissioning Project, Revision 1, May 2006
- Final Status Survey Plan, Ward Center for Nuclear Studies, Cornell University, Ithaca, New York, Revision 1, October 2006
- Working copies of miscellaneous EnergySolutions Field Services procedures
- Training records for selected personnel
- Selected records for instrument performance checks, source control logs, and radiological surveys

b. Observations and Findings

The inspector reviewed working copies of procedures and noted that they were sufficient in scope and detail to ensure safe working conditions, met necessary regulatory compliance, or met survey and documentation requirements of the Final Status Survey Plan. The inspector reviewed training records for special equipment (e.g. manlifts) to confirm that workers could safely perform survey activities at elevated locations in the reactor building of the Ward Center facility. Discussions with contractor personnel indicated that they were knowledgeable of radiation survey and radioactive waste procedure requirements.

The inspector observed a health physics (HP) technician perform surveys and demonstrate compliance with procedures for daily instrument performance checks. All radiation survey equipment examined had been calibrated within the prescribed frequency and performance checks had been recorded. The HP technician demonstrated appropriate control of calibration sources.

c. Conclusions

Procedures were sufficiently detailed so that workers could perform survey activities safely and in conformance with the requirements of the Work Plan. Training was provided for operation of specialized equipment (e.g. manlifts).

3. Decommissioning Activities and Radiation Protection Program

a. Inspection Scope (IP 69013)

The inspector interviewed licensee and contractor representatives, observed work in progress, and reviewed the following documents regarding decommissioning activities and the associated radiation protection program:

- Decommissioning Plan for the Ward Center for Nuclear Studies at Cornell University, Revision 1, July 2003
- Work Plan for the Cornell University Ward Center for Nuclear Studies Decommissioning Project, Revision 1, May 2006
- Final Status Survey Plan, Ward Center for Nuclear Studies, Cornell University, Ithaca, New York, Revision 1, October 2006
- Project personnel dosimetry records

b. Observations and Findings

Discussions with licensee and contractor representatives indicated that the facility had very low radiation dose rates and radiological contamination levels. As expected, the reactor components were the most significant radiological hazard during the demolition. These components were prepared for shipment by placing the material into 100 cubic feet (ft^3) B-25 containers with steel plate and concrete rubble for package shielding. The TRIGA reactor pool walls were demolished using a large demolition hammer mounted on a construction tractor. Due to the low contamination levels, only minimal scabbling on concrete surfaces was required. Most demolition debris was loaded into 20 cubic yard (yd^3) intermodal containers as described in the "Transportation Activities" section below.

The contractor employed contamination control measures to prevent dust from being released from the building and control potential radiological and silica exposures to personnel. During operation of the demolition hammer, multiple water sprays were directed onto the impact area for reduction of dust at the immediate source. In addition, the contractor operated eight 2000 ft^3 High Efficient Particulate Air (HEPA) filtration systems and three 5000 ft^3 HEPA filtration systems during dismantlement or decommissioning operations for dust control. Pre-filters were replaced at least once daily during significant operations. Air sampling was performed three times a day during the demolition operations. The contractor reported that all air sample results were less than detectable for radiological parameters.

Floor drains leading to a water collection sump in the building were covered prior to the start of demolition activities. Smear samples of the floor drains and sump showed no detectable activity.

Radiation doses to workers were monitored using dosimetry from an accredited vendor. Individual radiation doses to personnel for the entire project ranged from no

detectable to 131 millirem for the approximate seven-month project completion period. The cumulative personnel dose for the project was 366 millirem. The contractor reported that the only significant personnel exposure occurred during removal of the reactor equipment.

c. Conclusions

Demolition and decontamination activities employed by the contractor were consistent with the DP and work plan. The contractor used appropriate controls to limit airborne releases from the facility. The radiation protection program was effectively implemented through: conduct of radiation surveys, process and engineering controls to limit generation of airborne activity, airborne radioactivity sampling and measurement, and monitoring radiation doses to personnel.

4. Transportation Activities

a. Inspection Scope (IP 86740)

The inspector interviewed licensee staff and reviewed selected aspects of the following documents to ensure that transportation requirements were being met:

- Decommissioning Plan for the Ward Center for Nuclear Studies at Cornell University, Revision 1, July 2003
- Work Plan for the Cornell University Ward Center for Nuclear Studies Decommissioning Project, Revision 1, May 2006
- Selected records of shipments of radioactive waste

b. Observations and Findings

Radioactive debris from decommissioning activities was primarily loaded into intermodal containers (20 yd^3) for shipment and disposal at the EnergySolutions facility in Utah. Most shipments were trucked to the Alaron facility in Wampum, PA, where the containers were loaded onto railcars for the trip to Utah. The remaining intermodal containers were transported directly to Utah via truck. Shipments of B-25 containers and waste drums were also shipped to Utah via truck. The contractor packaged and shipped four drums of activated lead for disposal. The lead wastes were also trucked to the EnergySolutions facility and disposed in a separate hazardous material cell. The inspector reviewed the loading and packaging of one of the intermodal containers and did not identify any concerns with the shipment.

The inspector reviewed selected sets of shipping documents and found the records to be complete and accurate. Waste shipped for disposal met the U.S. Department of Transportation (USDOT) requirements for shipment as Low Specific Activity I. The drums, boxes, and containers used for waste shipments met USDOT requirements for industrial packages.

c. Conclusions

The radioactive waste transportation program implemented by the licensee's contractor met regulatory requirements.

5. Final Status Survey Activities

a. Inspection Scope (IP 83801)

The inspector interviewed licensee staff, observed work in progress, and reviewed selected aspects of the following documents:

- Decommissioning Plan for the Ward Center for Nuclear Studies at Cornell University, Revision 1, July 2003
- Work Plan for the Cornell University Ward Center for Nuclear Studies Decommissioning Project, Revision 1, May 2006
- Final Status Survey Plan, Ward Center for Nuclear Studies, Cornell University, Ithaca, New York, Revision 1, October 2006
- Final Status Survey Report, The Ward Center for Nuclear Studies, Cornell University, Ithaca, New York, January 2007
- Selected in-process survey records

b. Observations and Findings

The licensee's contractor conducted Final Status Survey (FSS) measurements in accordance with an NRC-approved FSS Plan. Based on discussions with licensee and contractor staff regarding use of radioactive materials within the facility, all survey units appeared to have been properly classified. Cornell Radiation Safety Office staff provided the contractor access to a liquid scintillation counter for evaluation of smear samples and water from drain systems. The contractor performed direct measurements on surfaces, general area radiation dose rate measurements, and gamma scanning measurements with appropriate, calibrated equipment.

Samples of surface soil from around the exterior of the Ward Center were collected and sent for gamma spectrometry analysis. The contractor also collected samples of the gravel/slag material from beneath the TRIGA reactor pool that were also analyzed by gamma spectrometry analysis. Gamma spectrometry analysis of these samples was performed for the contractor by General Engineering Laboratories in Charleston, SC. Review of selected analytical results indicated that the measurement technique used was sufficiently sensitive to meet the detection levels specified in the FSS Plan.

The inspector observed an HP technician perform selected measurements in support of the FSS Plan. The technician used appropriate, calibrated instrumentation for the

measurements. Data from measurements was recorded on forms identifying the area surveyed. The technician also demonstrated the daily performances tests and provided the records indicating required performance tests had been completed prior to making FSS measurements.

Survey data from the measurements required to support the FSS Plan were compiled into a FSS report that was submitted to the NRC for review.

c. Conclusions

Measurements, sampling, and analyses performed by the contractor were consistent with criteria specified in the FSS Plan.

6. Confirmatory Measurements

a. Inspection Scope (IP 83801)

The inspector made confirmatory measurements throughout the facility. In addition, the inspector obtained six split samples (three exterior soil samples and three slag/gravel samples from beneath the reactor pool) from the licensee's contractor and submitted the samples to the NRC's analytical contractor. The inspector reviewed the following documents:

- Final Status Survey Plan, Ward Center for Nuclear Studies, Cornell University, Ithaca, New York, Revision 1, October 2006
- Final Status Survey Report, The Ward Center for Nuclear Studies, Cornell University, Ithaca, New York, January 2007
- Letter Report for three Concrete and Three Soil Samples from Cornell University, Ithaca, New York, Oak Ridge Institute for Science and Education, November 15, 2006.

b. Observations and Findings

The inspector made confirmatory measurements throughout interior portions of the facility and outside the facility near the building exit where waste containers were removed from the building. Measurements were conducted using a Ludlum Model 19 Micro R Meter (NRC # 033514, calibration expiring 4/28/2007). The inspector made measurements that included, but were not limited to, general areas, interiors of ducts, wall-floor interfaces, the threshold of the large door exiting the west side of the Ward Center, the ZPR pit, and remediated surfaces beneath the former TRIGA reactor pool. All readings were indistinguishable from instrument background readings. The inspector confirmed elevated activity on a pallet of activated lead waste. The lead waste was subsequently shipped for disposal.

The inspector also obtained aliquots of six archived samples that had been collected and retained by the contractor. Three soil samples were from the exterior of the Ward

Center and three slag/gravel samples were from the area beneath the former TRIGA reactor pool. All samples were shipped to the NRC laboratory analytical contractor, The Oak Ridge Institute for Science and Education (ORISE) for gamma spectrometry analysis. Results of the analyses are presented in the table below. For the ORISE results, negative results, zero results, and results less than the listed uncertainty, all represent non-detectable concentrations of that radionuclide in that sample. The gamma spectrometry results indicate that residual radionuclide concentrations for all samples are less than the criteria specified in the DP. A copy of the ORISE letter report is attached.

GAMMA SPECTROMETRY RESULTS OF SELECTED SAMPLES
FROM THE VICINITY OF THE WARD CENTER

Sample Location	Sample Type	Radionuclide concentrations (pCi/g)			
		NRC Contractor data		Cornell contractor data	
		Co-60	Cs-137	Co-60	Cs-137
Under Reactor	Slag/gravel (1)	0.16 ± 0.05 (2)	0.02 ± 0.03	1.77 ± 0.15	< 0.1
Under Reactor	Slag/gravel	0.53 ± 0.06	- 0.01 ± 0.02	1.03 ± 0.13	< 0.1
Under Reactor	Slag/gravel	0.62 ± 0.05	- 0.01 ± 0.01	0.77 ± 0.11	< 0.1
South of Ward Bldg	Soil	0.04 ± 0.04	0.08 ± 0.03	< 0.1	0.141 ± 0.10
Southeast of Ward Bldg	Soil	0.00 ± 0.03	0.07 ± 0.02	< 0.1	< 0.1
East of Ward Bldg	Soil	0.02 ± 0.03	0.15 ± 0.03	< 0.1	< 0.1

(1) Sample type listed as concrete in ORISE analytical report. Material actually consisted of crushed slag/gravel matrix beneath the concrete base of the TRIGA reactor
(2) Uncertainties represent the 95% confidence level, based on total propagated uncertainties

c. Conclusions

NRC confirmatory measurements and confirmatory sample results did not identify radioactive material in excess of the criteria specified in the FSS Plan.

7. Exit Interview

The inspection scope and results were summarized on April 25, 2007, with Steve Byers, Thomas McGiff, and Lorna Hubble. The inspector discussed the findings for each area reviewed. The licensee acknowledged the findings.

Attachment: Supplemental Information

SUPPLEMENTAL INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

Joseph A. Burns, Vice Provost for Physical Sciences and Engineering
Charles R. Fay, Vice Provost for Research Administration
*Thomas McGiff, Radiation Safety Officer
*Steve Byers, Decommissioning Project Manager
Matthew Kozlowski, Project Coordinator
*Lorna J. Hubble, Radiation Safety Specialist

Licensee Contractor and Subcontractor Personnel

Michael Pries, Site Supervisor, EnergySolutions
Christopher Higgins, Radiological Engineer, EnergySolutions
Glenn Parkhurst, Waste Specialist, EnergySolutions
Leroy Cuneo, Health Physics Technician, DeNuke

* Denotes individuals who attended the exit briefing on April 25, 2007.

INSPECTION PROCEDURES USED

IP 69002	Class III Research and Test Reactors
IP 69013	Research and Test Reactor Decommissioning
IP 83801	Inspection of Remedial and Final Surveys at Permanently Shutdown Reactors
IP 86740	Inspection of Transportation Activities

LIST OF ITEMS OPENED AND CLOSED

None

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
DP	Decommissioning Plan
FSS	Final Status Survey
HEPA	High Efficiency Particulate Air
HP	Health Physics
IP	Inspection Procedure
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
USDOT	U.S. Department of Transportation
ZPR	Zero Power Reactor