INL/EXT-07-12603

University Reactor Conversion Lessons Learned Workshop for the University of Florida

Eric C. Woolstenhulme
Dana M. Meyer

April 2007

Idaho National Laboratory

The INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance

INL/EXT-07-12603

University Reactor Conversion Lessons Learned Workshop for the University of Florida

Eric C. Woolstenhulme
Dana M. Meyer

April 2007

Idaho National Laboratory
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Office of Nuclear Nonproliferation and Security Affairs
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517

ABSTRACT

The Department of Energy's Idaho National Laboratory, under its programmatic responsibility for managing the University Research Reactor Conversions, has completed the conversion of the reactor at the University of Florida. With this work completed and in anticipation of other impending conversion projects, INL convened and engaged the project participants in a structured discussion to capture the lessons learned. This lessons learned process has allowed us to capture gaps, opportunities, and good practices, drawing from the project team's experiences. These lessons will be used to raise the standard of excellence, effectiveness, and efficiency in all future conversion projects.

CONTENTS

ABSTRACT ... iii

ACRONYMS ... vii

1. INTRODUCTION ... 1

2. BACKGROUND ... 1

3. LESSONS LEARNED PROCESS ... 1

4. LESSONS LEARNED ... 2

4.1 General Conclusions ... 2

4.2 Lessons Learned Meeting Summary ... 3

5. LESSONS LEARNED BY PROJECT ACTIVITY ... 4

5.1 Initiating Conversion Project ... 4

5.1.1 Initiation ... 4

5.2 Conversion Proposal Process ... 5

5.2.1 Contract Negotiation ... 5
5.2.2 Proposal Preparation ... 6
5.2.3 Submittal of Proposal ... 7
5.2.4 Requests for Additional Information ... 8
5.2.5 Final Review and Comment on Proposal ... 8
5.2.6 Conversion Order ... 9

5.3 Fuel and Hardware Development and Procurement ... 9

5.3.1 Fuel Specifications and Drawings ... 9
5.3.2 Fuel Fabrication Statement of Work and Procurement Documents ... 10
5.3.3 Fuel Inspection ... 11
5.3.4 Preparation of Facility for Fuel Receipt ... 11
5.3.5 Reassembly ... 12

5.4 Core Conversion ... 12

5.4.1 Fuel Removal ... 12
5.4.2 Refueling ... 13

5.5 Spent Nuclear Fuel Shipment 14

5.5.1 Cask Determination 14
5.5.2 Transportation Plan/Security Plan 14
5.5.3 Route Assessment 15
5.5.4 Certification of University Quality Assurance Programs 15
5.5.5 Facility Preparations for Spent Nuclear Fuel Activities 15
5.5.6 Support Equipment/Tools for Spent Nuclear Fuel Activities 16
5.5.7 Appendix A Preparation 16
5.5.8 Shipping Documentation 17
5.5.9 Cask Loading 17
5.5.10 Receipt Facility Preparation 17

5.6 Other Issues 18

5.6.1 Safeguarded Information 18

6. ROUND ROBIN 18

7. ACTIONS 19

8. CONCLUSION 19

ACRONYMS

ANL	Argonne National Laboratory
DOE	U.S. Department of Energy
GA	General Atomics
HEU	highly enriched uranium
INL	Idaho National Laboratory
LEU	low-enriched uranium
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
SNF	spent nuclear fuel

University Reactor Conversion Lessons Learned Workshop for the University of Florida

1. INTRODUCTION

The Department of Energy's (DOE) Idaho National Laboratory (INL), under its programmatic responsibility for managing the University Research Reactor Conversions, has completed the conversion of the reactor at the University of Florida. This project was successfully completed through an integrated and collaborative effort involving INL, Argonne National Laboratory (ANL), DOE (headquarters and the field office), the Nuclear Regulatory Commission (NRC), the universities, and the contractors involved in analyses, fuel design and fabrication, and spent nuclear fuel (SNF) shipping and disposition. With this work completed and in anticipation of other impending conversion projects, INL convened and engaged the project participants in a structured discussion to capture the lessons learned. The objectives of this meeting were to capture the observations, insights, issues, concerns, and ideas of those involved in the reactor conversions so that future efforts can be conducted with greater effectiveness, efficiency, and with fewer challenges.

2. BACKGROUND

As part of the Bush administration's effort to reduce the amount of weapons-grade nuclear material worldwide, the National Nuclear Security Administration (NNSA) has established a program to convert research reactors from using highly enriched uranium (HEU) to low-enriched uranium (LEU) fuel.

The research reactor conversion effort is a critical step under the Global Threat Reduction Initiative's Reduced Enrichment for Research and Test Reactors program. As part of this program, NNSA is minimizing the use of HEU in civilian nuclear programs by converting research reactors and radioisotope production processes to the use of LEU fuel and targets. The HEU is weapons-grade nuclear material that can be used to make a nuclear weapon or dirty bomb. The research reactors are secure and are used for peaceful purposes; however, by converting these reactors to use LEU, a significant step is made toward ensuring that weapons-usable nuclear material is secure and safeguarded.

Among the list of research reactors targeted for conversion in 2006 were the University of Florida and Texas A&M University.

Reactor conversions include analyses, LEU fuel fabrication, reactor defuel and refuel activities, HEU packaging and transportation, and reactor startup.

3. LESSONS LEARNED PROCESS

The process for capturing the lessons learned from this project involved taking the schedule of the project activities and focusing feedback and discussion on each respective activity. The feedback and lessons learned discussions were held in an open discussion workshop, including all participating team members and their representatives. To promote a more expedient discussion at the workshops and to help the project team focus on the higher priority areas, a survey was developed and sent to project participants before the workshops. The survey invited those involved in the project to score and offer comments with regard to the projects activities in which they were involved. The survey was formatted with a 5-point Likert scale, where 1 was low or "extremely challenging," and 5 was high or "exceptional." The surveys were collected and scores were entered and averaged for each activity. The average score for each activity is identified in Section 5 of this document.

Based on survey scores and comments, the workshop agenda was established and timeframes were estimated. Consistent with expectations based on the survey results, the workshop discussions were brief for the unremarkable areas and more extended and detailed in those areas of greatest significance. The detailed lessons learned were captured and the themes and general conclusions were then drawn. The general conclusions and themes tend to apply to all activities (almost as operating principles) and will benefit future project teams and project managers. The more detailed lessons learned align to given activities and apply to the project manager and those involved in the given activity, as that activity is undertaken.

4. LESSONS LEARNED

4.1 General Conclusions

This project was clearly a success. Nonetheless, there were many detailed lessons learned regarding both technical and project management aspects. The specifics are provided in the following sections; however, some general elements are key to the success of future conversion and spent fuel shipping projects. Future projects will be conducted most effectively, efficiently, and with a minimum of risks, interference, and interruptions if the following are an integral part of the project:

- **Project team composition**, which includes a project team composed of individuals who are critical thinkers, flexible, and committed to the project results (the following was extracted from the comments submitted: "Having the right people who were willing to buy into the common vision and mission was critical. Everyone had a great personal work ethic. Having a single person who is solely dedicated to the project [allowing that person to stay in contact with all parties involved and to identify and track issues] was instrumental in the success of the project.").

- **Communication**, including inclusive communications and exchange that provides for effective sharing of needs, expectations, roles, responsibilities, data, assumptions, schedules, and facility and equipment constraints.

- **Use of expertise**, including confidence in and effective utilization of the varied expertise and experience of the team members.

- **Proactivity** and individual levels of initiative.

- **Early initiation** includes the earliest possible initiation of planning and activities at every step in the project process, thereby minimizing the likelihood of time-critical situations.

- **Verification and re-verification** of data, analyses, specs, assumptions, performance expectations, and equipment fit and function throughout the project.

- **Clear and common understanding**, including clear expectations of roles, responsibilities, technical variables, and technical results.

- **Knowledgeable and informed stakeholders** who can advocate for the project, remove barriers, and support decisions and adjustments needed to ensure project success (e.g., public, political, and administrative).

- **Compile reactor data** includes assembly or compilation of the historical documents that reveal what is known and unknown about the reactor.

- **Value-added government oversight**, in which the public interests are served, objectivity is retained, but NRC's experience and expertise is available to the project.

The above list comprised the general themes of the lessons learned meeting. The detailed lessons learned were discussed in the order of project activities, from initiation to closeout, and are provided in the following sections.

4.2 Lessons Learned Meeting Summary

The Lessons Learned Workshop for the University of Florida convened on February 22, 2007, at the General Atomics (GA) facilities in San Diego, California. The following were attendees at the workshop:

Dana Meyer, INL	Anthony Veca, GA
Eric Woolstenhulme, INL	Jason Yi, GA
Doug Morrell, INL	Ken Mushinski, GA
Dale Luke, INL	Jim Matos, ANL
Jim Wade, DOE-ID	Ali Haghighat, UF
Parrish Staples, DOE-NNSA	Benoit Dionne, UF
Scott Declue, DOE-SRS	Roy Boyd, STS
Alexander Adams, NRC	Chip Shaffer, BWXT
Bill Schuser, NRC	

The following was the agenda for the workshop:

8:00 Welcome and introductory remarks

- Establish ground rules and review agenda

8:30 Discuss and collect lessons learned by each major activity area

- Initiating Conversion Project
- Conversion Proposal Process

10:15 Break

10:30 Discuss and collect lessons learned by each major activity area (continued)

– Fuel and Hardware Development and Procurement

12:00 Lunch

1:00 Discuss and collect lessons learned by each major activity area (continued)

– Core Conversion

– SNF Shipment

2:20 Break

2:35 Discuss and collect lessons learned by each major activity area (continued)

– Other areas needing to be addressed

3:35 Next steps and assignments

4:10 Closing remarks

4:30 Adjourn

5. LESSONS LEARNED BY PROJECT ACTIVITY

The detailed lessons learned were discussed in order of project activities, from initiation to closeout, and are provided in the following sections.

5.1 Initiating Conversion Project

5.1.1 Initiation

The average survey score was 3.88.

Issues	Recommendations
Open communication between the university and the program went a long way in resolving a question of roles and responsibilities. In this case, the program analysts wanted to conduct the analyses, while the university believed they should perform them. The university saw it as an opportunity to thoroughly understand their reactor. A meeting was held to discuss the university's desires, rationale, and subsequently their capabilities and scope of analyses, and it was agreed to allow the university to do the analyses, with the program analysts providing guidance and expertise, as needed.	A valuable lesson learned in this regard was for the program to understand and respect the university's objectives, and the related programmatic benefits, and assist them as needed to accomplish their goals. With regard to the question of who would do the analyses, we needed confidence in each others' respective capabilities, clarity, and agreement of roles based on those capabilities, and subsequent demonstration of those capabilities in the undertaking of the project.

Issues	Recommendations
The university team was segregated a bit and it was not clear if all the necessary information was being shared appropriately.	A kick-off meeting with the university, designer, fabricator, analyst, shipping support, and shipper should take place as soon as possible to facilitate formal and systematic documentation of ALL technical and functional requirements for the entire project in a technical and functional requirements document. This would clarify roles, expectations, and requirements, and especially ensure that each piece of the design/specification could be verified against those requirements. Technical and functional requirements documents would be signed and become the "binding" document that everyone must abide by. Doing this will help eliminate many of the design problems that were experienced on this project. It would be a living document that gets revisited at each review.
Insufficient coordination of reviews caused delays and confusion.	Explicitly discuss "who else" needs to be "on board" to determine the support needed and establish essential contacts for review and information. Direct the university to provide, at the preliminary meetings, a list of those individuals that they want to review drawings, specs, and such.

5.2 Conversion Proposal Process

5.2.1 Contract Negotiation

The average survey score was 3.0.

Issues	Recommendations
Delays were experienced in the contracting process due, in large part, to lack of understanding of the work and time constraints by the contracts representatives.	Involve contracts/procurement people early in the process to promote an understanding of the work that mitigates nonessential delays.
Procurement and contracts personnel play a pivotal role in managing risks and clarifying obligations through the contracting process. However, their effectiveness can be suboptimized if they are ill-informed and are not involved early.	Start negotiations early to ensure the procurement process is less troublesome. Involve procurement personnel from both parties early, so that all parties are informed and working together.

5.2.2 Proposal Preparation

The average survey score was 2.83.

Issues	Recommendations
The age and history of any given reactor potentially allows for the likelihood that changes have occurred in designs, equipment, functionality, and such. These changes impact the design, analysis, and any number of activities on these projects.	Advise university early (at the start of the process or at the initial phase of the analysis) to recover and provide any historical documents, geometries, specifications, and such that are available. They also need to identify what information is missing so they can conduct whatever activities are necessary to fill those data gaps.
Lots of time was spent up front trying to determine format, content, and such. A clearer guideline of what the format (and some boilerplate) would be extremely helpful in preparing the proposal.	Now that it has been published, we need to use the NRC guide/template when preparing the proposal.
Although proposals are not due until a specific date, involvement of NRC to conduct upfront negotiations and clarify expectations and contractual obligations DURING proposal development would greatly improve the process.	Involve NRC in the proposal process as soon as reasonable regarding those areas where NRC involvement is stipulated (i.e., before the postal worker drops it off).
Proposal preparation went well. Lots of interaction back and forth with a clear, comprehensive plan and identification of who was responsible for what.	Embrace a collaborative and interactive operating philosophy, yielding constructive and clear communication and exchange.
The NRC oversight was value-added yet remained objective. Several aspects of the proposal can only be decided by NRC; therefore, early, open involvement is crucial. Use NRC as a technical resource/sanity check, and not just for answering administrative-type questions (e.g., changes to technical specifications), puts NRC in a position to "advocate" the conversion proposal on behalf of the university. Anytime the proposal preparer questions how NRC might react to a point, he/she needs to call and ask.	Use NRC as a technical resource/sanity check and not just for answering administrative-type questions. Anytime the proposal preparer questions how NRC might react to a point, he/she needs to call NRC and ask.

Issues	Recommendations
There is a risk in preparing the conversion proposal while developing the fuel, because gaps, tolerances, and such must be known, documented, and understood.	Complete the design before preparing the conversion proposal. This will ensure the correct design specs are included. The proposal can then move forward with significantly minimized risk. Transmit final drawings for fuel design to NRC to support their review of the analyses.
Picking overly restrictive tolerances causes safety limits to come down. Any future changes in design means analyses have to be revisited and sometimes revised. Over conservatism in tolerances may make fabrication nearly impossible. For example, the University of Florida proposal asked for a ±1 mil tolerance across a 26-in. element. This was rigorously discussed internally at the University of Florida and ANL (who conducted the analysis), but was not discussed with the designers at INL who would have resisted such a limited tolerance.	Be less restrictive during the analysis so that we are not so limited/restricted in the design. The fabricator and the designer MUST collaborate very closely at every phase of the process, almost as if they were the same entity, so that nothing is lost or overlooked. Better lines of communication between those conducting the analysis and those who are designing/fabricating the fuel are essential. This will go a long way to resolving the impacts of gap tolerances, design changes, and such. Involve ALL parties (e.g., analysis, design, fabrication, and university) in ALL conversations that will impact them directly or indirectly. Err on the side of inclusion and let people opt out.

5.2.3 Submittal of Proposal

The average survey score was 3.20.

Issue	Recommendations
Some confusion existed on whether the submittal should be paper copy or electronic and how many copies were needed.	Call NRC when ready to submit the proposal and ask the question.

5.2.4 Requests for Additional Information

The average survey score was 4.50.

Issues	Recommendations
After issuing the request for additional information, NRC visited the university to discuss their resolutions/dispositions to the questions. This was extremely effective and worked to expedite the question resolution process.	Continue this practice.
Before collaborative dialogue with NRC, the university and ANL prepared a draft response to the request for additional information so that discussions during the visits/proposal review were focused on the content of the response rather than on understanding and clarifying the request for additional information. This significantly accelerated the process.	Continue this practice.

5.2.5 Final Review and Comment on Proposal

The average survey score was 4.50.

Issues	Recommendations
This worked really well. Daily telecons to discuss and resolve issues and the willingness of participants to give and take to make it work was invaluable. Great interaction, initiative, listening, flexibility, and such.	Continue these practices.
The common vision and mission were critical.	Communicate these at the start of the project to all concerned, and continue to refer to them throughout the project.
Everyone had a great personal work ethic.	As much as practicable, select team members with established track records of success and excellence.
We had a single person (Dana for INL and Benoit for the University of Florida) that was solely dedicated to the project (allowing that person to stay in contact with all parties involved and to identify and track issues). This was instrumental to the success of the project.	Identify a key point of contact for the program and for the university to act in these roles.

5.2.6 Conversion Order

The average survey score was 3.50.

Issue	Recommendation
The NRC conversion order process went very smoothly. NRC provided great support and quick response to the proposal. This was highly appreciated.	Keep NRC informed; respect their role while leveraging their experience and expertise.

NOTE: Many of these issues are discussed with regard to collaboration and clarification between designers and fabricators. Communication and misunderstandings appear to be the biggest issue. Designers and fabricators (and analysts) need to talk openly and often. Inclusive (i.e., all parties) communications is critical.

5.3 Fuel and Hardware Development and Procurement

5.3.1 Fuel Specifications and Drawings

The average survey score was 2.20.

Issues	Recommendations
Design decisions did not include all essential members of the University of Florida team.	Advise the university about how critical it is to communicate and disseminate information among its own team.
Many players do not have experience reading drawings.	Assistance from other departments or organizations should be enlisted to assist the university in areas where it is needed.
The INL prepared mockups of components, and then when the University of Florida changed the specifications based on an analysis, INL would have to redo the mockup. This is expected; however, open and frequent communication can significantly minimize the impacts of those occurrences and the rework involved.	Anticipate an iterative process and advise those involved that the process will be that way. The design and specifications will change. We need to be ready for it and not resist when such changes come.
Absence of spacing and tolerance specifications created confusion.	Spacing requirements and tolerances need to be clearly documented on the drawing.

Issues	Recommendations
Assumptions with regard to design, fit, and function proved invalid, requiring correction.	Identify and document requirements such as spacing, tolerances, fit-up, and such in a technical and functional requirements document. Test all assumptions and VERIFY. Check the details early on, perhaps as early as the initial kickoff meeting. Perform mockups of designs to verify the designs work. Include mockups as part of the critical path so they are not forgotten. Verifying assumptions, specs, designs, and such is especially critical when continuity has been interrupted or extended in the process.

5.3.2 Fuel Fabrication Statement of Work and Procurement Documents

The average survey score was 2.78.

Issues	Recommendations
Issues regarding fuel fabrication quickly arose nearing the end of the process (e.g., questions on fabrication process, quality assurance programs, and channel spacing.)	Advise the university to become familiar with the fuel fabrication company's quality assurance documents and process. Involve the university in review and verification of the fabricator's quality assurance program. Ensure the preliminary meeting between all parties (e.g., university, analysts, designers, and fabricators) occurs to discuss what each party will get at each phase of the process. These same parties should be included in status and issues conversations throughout the process. Communicate all requirements for analyses and fabricability with all affected organizations.
The INL/DOE relied on the licensee to maintain the relationship with NRC and generally did not get involved with that relationship. When changes had to be made due to fabrication and analyses issues, NRC was not informed in a timely manner.	Advise and encourage the licensee to communicate openly with NRC regarding changes to fuel design and such. Need to ensure design is COMPLETE before submission of the proposal.

Issues	Recommendations
The magnitude of support needed to accommodate the changes in design and analyses was overwhelming at times due to constraints in time.	Planning and funding needs to anticipate making resources available to handle the simultaneous work.

5.3.3 Fuel Inspection

The average survey score was 4.00.

Issues	Recommendations
The blue books did not come with the fuel (i.e., several weeks delayed). The inspections were accomplished using advanced email or faxed copies rather than the final books. Could not verify individual plates because the serial numbers are too small to read and the plates were fastened into the elements. Having the blue books would have helped alleviate this problem because the books would have documented the inspectors' conclusions that the plates were as indicated on the drawings.	Ensure the quality assurance documents are provided up front. ACTION: BWXT will check to see why the blue books were not sent with the fuel.
Markings, labeling, and data were incomplete or scattered.	Pull together all markings, labeling, and data before inspections. Conduct both source inspections and receipt inspections. Advise the university to go to the fabricator and inspect the fuel before shipping.

5.3.4 Preparation of Facility for Fuel Receipt

The average survey score was 3.60.

Issues	Recommendations
The University of Florida was very restricted in their receipt area. Knowing what size of trucks could be accommodated was very helpful in coordinating the receipt of fuel. Communication of logistics between the university and the shipper was critical to successful receipt of the fuels.	Ensure the university and shipper communicate with regard to logistics, restrictions, and such.

Issues	Recommendations
Several different types of 6M drums were used at the University of Florida. The hardware needed for these drums was not communicated to the university.	Have shipper advice the university about the type of 6M containers (e.g., drawings and opening mechanisms) that will be arriving, so that the right tools are onsite at the receipt location.

5.3.5 Reassembly

The average survey score was 3.33.

Issue	Recommendation
Shipping assistance had to be provided to the university to return the empty canisters because the University of Florida was not familiar with the process (e.g., paperwork).	Make time early in the process to inform the university about the requirements for return shipment.

5.4 Core Conversion

5.4.1 Fuel Removal

The average survey score was 3.33.

Issues	Recommendations
A 90-day shutdown period is required before shipping the SNF. This timeframe needs to be closely coordinated with the university to ensure reactor needs are met and all implications of the shutdown are considered.	Make the university aware of the 90-day requirement and advise them to consider the implications of the schedule on reactor operations and research.
Contractors assisting the university with activities had unescorted access at the facility. Having Secure Transportation Services qualified as secondary operators at the reactor facility was instrumental during operational activities. This enabled them to move around and get things done without having to be constantly escorted.	Have contractors qualified as secondary operators at the reactor facility, and provide them with unescorted access.

5.4.2 Refueling

The average survey score was 3.50.

Issues	Recommendations
Several activities (e.g., maintenance, measurements, and disassembly) were required that could have been carried out earlier. This created a backlog as those activities became critical path and created additional schedule impacts.	Consider these activities early on, identify those that can be done earlier in support of conversion and schedule them. Add additional maintenance-type activities explicitly to the schedule so that they can be considered in the timing of the project. Activities that can be performed before receiving new fuel and reactor startup should be done as soon as possible, so as to not interfere with critical activities.
There was some unfamiliarity with the tools/equipment that needed to be resolved real-time during refueling activities. During loading, reactivity measurements were not reconciling with the University of Florida's calculations, causing uncertainty, questions, and undue stress on the operation. Reactivity at intermediate loading had not been calculated.	Require the university to have a comprehensive plan for refueling so they have a basis to reconcile differences between the analysis and the core measurements. This will be a formal commissioning/startup plan that compares calculated reactivity to measured values at intermediate loading during the refueling process. If possible, provide for onsite expertise to resolve startup issues during refueling. In the absence of onsite expertise, have a detailed plan and procedures with lots of hold points. Clarify explicit roles and responsibilities (e.g., what-ifs and ways to respond).
The university encountered unanticipated situations with regard to support equipment operability or function. Numerous questions arose as to how to respond to the arising issues.	Check all needed equipment (maintained and verified as operable) BEFORE you get to the critical point where it is needed. Conduct routine maintenance and pre-activity walk downs/ inspection of all needed equipment.

5.5 Spent Nuclear Fuel Shipment

5.5.1 Cask Determination

The average survey score was 3.67.

Issues	Recommendations
The university found the process for shipping SNF/cores offsite overwhelming due to the volume of orders and the regulations that applied. Even though lots of guides and documents are available, the pure volume of details and the uniqueness of what needs to be done takes time and coordination.	Anticipate the likelihood of trepidation and the sense of being overwhelmed. Be prepared to provide encouragement, support, and guidance. Develop a generic guide and a workshop to discuss shipping issues and put those who will be responsible for shipping in contact with those who have already done it. ACTION: Scott Declue will schedule a workshop to discuss the related issues and draft a guide in support of SNF shipping.
Lots of information was gained during walk downs. This was especially valuable when done in the preplanning stages. It opened the door for lots of questions to be addressed early on.	Continue to conduct these walk downs as a matter of practice.

5.5.2 Transportation Plan/Security Plan

The average survey score was 3.0.

Issue	Recommendation
Transportation and security plans are usually developed in tandem so the appropriate information can be conveyed, where allowed, with the parties. On this University of Florida effort, we were under a security information lockdown due to regulatory changes regarding safeguarded information, and were not able to share everything we needed to share.	The lockdown is over now, so this should not be a problem in the future. Need to begin the fingerprinting process early, and make it appropriately and effectively inclusive (include shippers).

5.5.3 Route Assessment

The average survey score was 3.2.

Issue	Recommendation
The route assessment was performed late in the process.	Conduct the route assessment as early as possible. Anything being shipped from a new location needs to have the route assessed as early as possible.

5.5.4 Certification of University Quality Assurance Programs

The average survey score was 3.0.

Issues	Recommendations
Universities are, in large part, unfamiliar with establishing a quality assurance program and writing a quality assurance plan.	Refer to other experienced universities, such as MURR (Missouri), for guidance to the NRC guidance.

5.5.5 Facility Preparations for Spent Nuclear Fuel Activities

The average survey score was 3.60.

Issue	Recommendation
Proactive, early involvement in preparing facilities for SNF activities is critical to success	Encourage and facilitate the inclusion of those involved in SNF activities in early discussion and preparations.

5.5.6 Support Equipment/Tools for Spent Nuclear Fuel Activities

The average survey score was 3.60.

Issues	Recommendations
A lid was built in accordance with the drawing; however, no one realized that the drawing was looking up at the lid. Subsequently, the lid was inverted. The error was caught during an unplanned dry run that was conducted during a project delay; therefore, no time was lost. Had there not been a delay, the project would have been hard pressed to correct the error.	(1) Pay closer attention to detail, and (2) conduct dry runs of newly designed equipment.
Each facility has its own equipment needs.	Identify specific equipment needs as early as possible.

5.5.7 Appendix A Preparation

The average survey score was 2.5.

Issues	Recommendations
Identification numbers on the fuel did not match the identification numbers listed in Appendix A.	Convey the importance of fuel element identification numbers to the shipper. If a discrepancy is found in the numbers, it should be documented and faxed to the field office immediately for response and resolution.
The university was not experienced nor prepared for the requirements of Appendix A submission. The preparation can be cumbersome, complex, and confusing.	Advise licensees of the requirements of the Appendix A submittal. Prepare a simplified guidance document (similar to a 1040A tax form) to show licensees how to prepare Appendix A. ACTION: Scott Declue will schedule a workshop to review Appendix A requirements and come up with a plan for providing the needed guidance.

5.5.8 Shipping Documentation

The average survey score was 3.0.

Issues	Recommendations
Required labels on the cask were torn off during transport due to harsh weather conditions.	Harsh weather conditions need to be considered when affixing labels.
Photos were taken of the BMI cask before shipping, showing the labels were in place before leaving the university.	Continue this practice of taking photos. They can be essential in providing information as a verification mechanism to regulating entities, especially when things change during transit.

5.5.9 Cask Loading

The average survey score was 3.67.

Issue	Recommendations
The lid for cask loading required rework.	Performing a "dry-run" of loading activities is essential to identifying problems with procedures, equipment, and such.

5.5.10 Receipt Facility Preparation

The average survey score was 3.33.

Issue	Recommendations
The University of Florida needed to have SNF shipped offsite in an extremely compressed schedule due to many factors (e.g., availability and scheduling of BMI casks and security issues of holding HEU in storage at the university). Additionally, hurricane force rain and winds impacted transport.	Advise university of the need for comprehensive planning, attention to detail, and anticipation of all relevant factors in preparing, scheduling, and shipping SNF. Have flexibility to relax the schedule if safety issues are a concern.

5.6 Other Issues

5.6.1 Safeguarded Information

The average survey score was 3.0.

Issues	Recommendations
The safeguards information issues have been resolved at NRC.	Submit fingerprints and other such information as soon as possible.

6. ROUND ROBIN

In concluding the discussion of the lessons learned, all participants were invited to reiterate, summarize, or offer any other lessons learned. The following list provides their final thoughts:

- There were lots of challenges on this project, but the team pulled together to meet those challenges and complete the project on schedule. Well done.

- The key to success was that everyone had the same goal and worked together to accomplish it.

- Next time we decide to use cones on the fuel plates, we need to taper them and not use hard edges. They do not go into the box very easily when they have hard edges.

- If we decide to have a workshop (e.g., initial orientation to the work and expectations), let us consider a single, comprehensive document and guidance that will address all of these issues with appropriate templates. It would be ineffective to pull all these people together in separate meetings to discuss each issue separately. A single guidance document and workshop would be the most efficient way to address it.

- Everyone in the project was working at or near capacity; therefore, the stress level was very high. It is great to work with people who can perform under such circumstances and know their limits so the work is (was) appropriately managed.

- It takes some time after refueling for the university to get the reactor up and running and to get operations back to normal. During this time, new operating procedures have to be written and operators have to be trained to the new procedures. The message here is that you will not start conversion on Monday and be back to full operation the next Monday. The transition and startup time after refueling needs to be planned for and coordinated. Additionally, the universities must prepare and have knowledge of reactor physics with appropriate onsite expertise. Certain parameters are needed to run tests in the reactor, and many of the operators do not have the reactor physics knowledge to do it. Depth of knowledge is the issue.

- Need to add operator training to the commissioning/startup plan that is discussed above. This is where the analysis information is conveyed to the operator. New operating procedures also need to be written, trained to, and implemented.

- Steps to success—communicate, plan, verify, and communicate. We need to involve future licensees in the next lessons learned meeting so they can have the information up front.

- Do not submit the conversion proposal and application until the information is full and complete.

- How issues are handled when they arise is a good indicator of the strength of the team. This was a great team.

7. ACTIONS

Scott will take the lead to establish a workshop to address activities needed for SNF shipping.

BWXT will check to see why the blue books were not sent with the fuel.

8. CONCLUSION

This lessons learned process has allowed us to capture gaps, opportunities, and good practices, drawing from the project team's experiences. The process is inclusive and offers an opportunity for every entity that "touched" the project to share from its experience. These lessons will be used to raise the standard of excellence, effectiveness, and efficiency in all future conversion projects. Despite making improvements to successive projects by addressing the lessons we have learned on this project, conducting a lessons learned activity will be vital to each conversion project as technologies, regulations, and other aspects of the environment change and influence success. It is recognized we cannot become complacent, nor adopt a mindset that the process has been "perfected."

Maastricht University alumni can participate until six months after graduation. All workshops, lectures and training courses are free of charge. However, please have a look at our information about registration and cancellation policy. Below the table you can find a short description of all the lectures, workshops and training courses.Â * All lectures, workshops and trainings take place online, with the exception of the presentation skills workshop. * * This workshop is exclusively for boards of student and study organisations. Please contact us through careerservices@maastrichtuniversity.nl and check the available dates for this workshop.Â You will get useful links to further practice all lessons learnt at home. See when the workshops will be held and register to participate. Niet ge- definieerd. The University of Florida Training Reactor (UFTR), commissioned in 1959, is a 100 kW modified Argonaut-type reactor at the University of Florida in Gainesville, Florida. The UFTR is a light water and graphite moderated, graphite reflected, light water cooled reactor designed and used primarily for training and nuclear research related activities. The UFTR is licensed by the Nuclear Regulatory Commission and is the only research reactor in Florida. Admissions Requirements for University of Florida. Admissions at UF are considered More Selective, with 45% of all applicants being admitted. In the 2017/2018 school year, of the students who applied to the school, only 23% of those who were admitted eventually ended up enrolling.Â The University of Florida Academic calendar runs on a semester basis. In the 2017/2018 school year the student to faculty ratio was 20:1. There are 2096 full time instructional teachers.Â Students should consult with a representative from the school they select to learn more about career opportunities in that field. Program outcomes vary according to each institutionâ€™s specific program curriculum. Financial aid may be available to those who qualify.