June 30, 2005

Mr. E. William Brach, Director
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: FEASIBILITY REPORT ON THE JOINT CANADA-UNITED STATES INITIATIVE ON TYPE B(U) AND FISSILE MATERIAL PACKAGE APPROVAL

Dear Mr. Brach:

Enclosed is the Feasibility Report that was developed by the Working Group for the Joint Canada-United States Initiative on Type B(U) and Fissile Material Package Approval. The purpose of this report is to provide you with a current status of the project and to let you know that the next phase of the project will be to develop a draft Applicant's Guide and Reviewer's Guide. Ultimately, these documents will be used within the framework to facilitate the Canadian-United States package revalidation process.

The Feasibility Report includes a summary of the activities of the Working Group, the Working Group Charter for the project, and a Compatibility Assessment. Note that the Working Group decisions contained in this Report and the products that will be produced related to this initiative do not necessarily represent the official views of each respective regulatory authority.

Please let me know if you have any questions on the content of this report. I can be reached at 301-415-8486.

Sincerely,

/RA/

David W. Pstrak, Working Group Chairman
U.S. Nuclear Regulatory Commission
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Enclosures:
1. Feasibility Report
2. Working Group Charter
3. Compatibility Assessment

Mr. E. William Brach, Director
Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: FEASIBILITY REPORT ON THE JOINT CANADA-UNITED STATES INITIATIVE ON TYPE B(U) AND FISSILE MATERIAL PACKAGE APPROVAL

Dear Mr. Brach:

Enclosed is the Feasibility Report that was developed by the Working Group for the Joint Canada-United States Initiative on Type B(U) and Fissile Material Package Approval. The purpose of this report is to provide you with a current status of the project and to let you know that the next phase of the project will be to develop a draft Applicant's Guide and Reviewer's Guide. Ultimately, these documents will be used within the framework to facilitate the Canadian-United States package revalidation process.

The Feasibility Report includes a summary of the activities of the Working Group, the Working Group Charter for the project, and a Compatibility Assessment. Note that the Working Group decisions contained in this Report and the products that will be produced related to this initiative do not necessarily represent the official views of each respective regulatory authority.

Please let me know if you have any questions on the content of this report. I can be reached at 301-415-8486.

Sincerely,

/RA/

David W. Pstrak, Working Group Chairman
U.S. Nuclear Regulatory Commission
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Enclosures:
1. Feasibility Report
2. Working Group Charter
3. Compatibility Assessment

ML051820449

DISTRIBUTION:
SFPO r/f NOsgood, SFPO MRahimi, SFPO KHenderson, OIP
CRosales Bush, OIP
E:\Filenet\ML051820449.wpd
C = COVER E = COVER & ENCLOSURE N = NO COPY *See previous concurrence
Identical letters will be sent to Boyle (USDOT), Nelson (CNSC), and Jammal (CNSC)

OFC:	SFPO	E	SFPO	
NAME:	DPstrak*		WRuland*	
DATE:	6 /29/05		6 /30/05	

OFFICIAL RECORD COPY

Feasibility Report on the Joint Canada-United States Initiative on Type B(U) and Fissile Material Package Approval

Introduction

Over the past 5 months, the Working Group for the "Joint Canada-United States Initiative on Type B(U) and Fissile Material Package Approval" has met to discuss the details of working toward a more streamline, efficient, and effective means of package revalidation between Canada and the United States (U.S.) without the need for additional technical review. As stated in the Working Group Charter, the next step in this initiative is to present management with a Feasibility Report which includes the technical analyses and preliminary conclusions for the major areas associated with package reviews. The intent of this Report is to provide management with a snapshot of the current status of the project. The final products to be developed during this project will be a Reviewer's Guide and Applicant's Guide. These guides will include the elements summarized in the attached Compatibility Assessment.

Summary

The Working Group for this initiative finalized the Charter at the first meeting in February, 2005. Since then, the members have reviewed various documents and regulations in an effort to determine the extent of the similarities and differences between the two country's package standards and review practices. During the reviews, the Working Group focused on the Canadian Office Consolidation entitled, "Packaging and Transport of Nuclear Substances Regulations" (SOR/2000-208), the Canadian "Draft Approval of Certified Packages in Canada" (Rev. 2, 6/04), and the "Approval Process for New Certified Canadian Packages." Other documents reviewed included the U.S. Nuclear Regulatory Commission Regulatory Guide 7.9, "Standard Format and Content of Part 71 Applications for Approval of Packages for Radioactive Material" (Rev. 2, 3/05), NUREG 1609, "Standard Review Plan for Transportation Packages for Radioactive Material", 10 CFR Part 71 of the U.S. Code of Federal Regulations, and the International Atomic Energy Agency Safety Standards Series (TS-R-1, 1996). Based on these reviews, the Working Group met in May, 2005, to present and discuss the similarities and differences in the package approval process for Canada and the U.S. These discussions led to the Compatibility Assessment and Preliminary Conclusions which follow.

Based on the determination that differences in the package approval standards and practices exist between Canada and the U.S., the Working Group focused on ten key areas of the approval standards. Within these areas, a comparison was made between the Canadian transport package standards which, in general, are based directly on TS-R-1, and 10 CFR Part 71, which are harmonized with, but are different than TS-R-1. This approach was selected due to the fact that Canada applies the packaging standards in TS-R-1 during its package review, and the U.S. applies the regulations in 10 CFR Part 71. Thus, a comparison of these two sets of transportation regulations adequately captures the similarities and differences of the respective review processes.

Conclusion

The Working Group has determined that although differences exist, they are not insurmountable and can be worked into the forthcoming Applicant's Guide and Reviewer's Guide. Where differences appear, the most restrictive standard would be selected for use. In general, the most restrictive standard does not present a significant additional regulatory burden. The Working Group does not believe that the differences present a reduction in package safety, and see an overall benefit in moving forward with this project.

Included in this report is the Working Group Charter and the Compatibility Assessment.

Joint Canada-United States Initiative on Type B(U) and Fissile Material Package Approval

Working Group Charter

1. Purpose -
The purpose of this working group (WG) is to develop guidance documents for (1) package designers (in the form of an applicant's guide), and (2) competent authority reviewers, that will enhance the North American system for unilateral approval of Type B(U) and fissile material package designs. Within these guidance documents, the required elements necessary for package approval within each respective country will be included. It is understood from the outset that reciprocity concerning package approval is not one of the goals of the WG. In the context of this charter and international transportation, "unilateral approval" means an approval of a design which is required to be given by the competent authority of the country of origin of the design only.

2. Background –
The universal acceptance of unilateral approvals for Type B and fissile material packages, without additional package review by affected member states, has remained an elusive goal for many types of transport packages. In principle, each member state should use IAEA Regulations as the basis for package approval, and that approval should be accepted by all other member states, with little or no requirement for additional technical review. In practice, member states have routinely insisted upon the need to review Type B(U) and fissile material packages. Implementation issues are influenced by the perspectives that individual member states have concerning risk, safety margins, and because of other differences in engineering standards, documentation, and quality assurance requirements. If any progress is to be made towards the universal acceptance of Type B(U) and fissile material packages, a framework needs to be developed in which these different perspectives, as well as the qualification of technical reviewers, can be addressed, resolved, and documented.

3. Objective -
Currently, practice in Canada and the US is to perform some type of technical review of packages approved by the other country before issuing the Competent Authority approval. This process may be lengthy and is complicated by differences in domestic regulations, interpretation of IAEA regulations, package application format, and acceptance criteria. The objective of this project is to develop a framework that facilitates the US/Canadian revalidation of each other's certificates without additional technical review.

4. Membership -
WG membership shall consist of 1 or 2 staff from each of the Canadian Nuclear Safety Commission (CNSC), the United States Department of Transportation (DOT), and the United States Nuclear Regulatory Commission (NRC). The WG will select a chairperson (which may rotate) and make a recommendation to management as to the need for contractor assistance.

5. Roles and Responsibilities -
The WG products will not be construed to represent official views of the respective competent authorities. All WG products should reflect consensus of the WG members.

The roles and responsibilities of the WG chairperson are to: (1) ensure that everyone's viewpoints have been fairly considered, (2) set up, run, and document the WG meeting, (3) ensure compliance with the WG schedule or promptly inform WG members and management of the variation.

The roles and responsibilities of WG members are: (1) to represent his/her views and respect the views of the other members; (2) attend the meetings or arrange for a substitute; (3) respond to actions from meetings in a timely manner.

6. Methods and Procedures -
To facilitate the effective development of the Joint Canada-US Package Approval Guidance, the WG members supporting this initiative shall meet periodically (in person or via teleconference) to discuss issues and resolutions, the progressive path forward, and steps for achieving the goal. The total number of expected meetings is 3 to 4, and the tentative schedule for completion is given in section 9 below.

7. Meetings -
Person-to-person meetings will alternate between locations in the United States and Canada. To the extent practicable, the WG will make use of teleconferencing and video conferencing facilities to minimize travel burdens. All WG meetings will be non-public meetings unless the WG concludes that a workshop is necessary to obtain stakeholder input on the path forward. Such workshops would be open to the public.
A draft agenda will be developed and provided for comment before each meeting. A draft summary of each meeting will be provided to each member via e-mail in a timely manner. The members will review the draft and submit comments to the chairperson. The chairperson will issue the final meeting notes via e-mail.

8. Products -
The products of this initiative will include:

- A summary of the similarities and differences between the two countries with respect to:
    - Regulatory Standards – IAEA package standards vs Part 71 package standards
    - Methods – Administrative and technical reviews, including documentation, oversight of design development and testing, technical review process
    - Acceptance Criteria and Practices – Review procedures and Standard Review Plan

- Based on the above reviews, a feasibility report for CNSC, DOT, and NRC management, of the issues towards a Joint Canada-US Package Applicant's Guide and a Reviewer's Guide
- A Draft Joint Canada-US Package Applicant's Guide for package design applications under NRC and CNSC regulations
- A Draft Joint Canada-US Package Reviewer's Guide for package design applications
- A proposed path forward for implementation of the Applicant's and Reviewer's Guides
- A feasibility report for CNSC, TC, DOT and NRC management to discuss future actions regarding potential expansion of the Joint Canada-US initiative internationally

9. Tentative Schedule – by: [Note: This tentative schedule will be adjusted based on input gained during the WG meetings.]
2/05 - Conduct first meeting (Washington, DC/NRC Headquarters)
4/05 - Develop the summary of the similarities and differences between the two countries in package approval methods
4/05 - Conduct second meeting (CNSC Ottawa)
6/05 - Develop the feasibility report and provide to management
7/05 - Develop draft Applicant's Guide
7/05 - Conduct third meeting (Washington, DC/DOT Headquarters)
8/05 - Develop draft Reviewer's Guide
9/05 - Teleconference or possible additional meeting
9/05 - Develop proposed path forward for implementation
10/05 - Develop the feasibility report and provide to management on international approach

COMPATIBILITY ASSESSMENT

The Working Group reviewed Canadian and U.S. regulations, regulatory guidance, and standard practices, to identify and evaluate differences in package approval standards in the two countries. Regulatory standards and established review practices were considered. A number of differences were identified, and were grouped into 10 major technical areas. For each technical area, the differences were considered, and an evaluation was performed to assess whether the differences would present an impediment to the goal of bilateral package approval. The conclusion was that, in a practical sense, these differences will not impact the joint package approval process. The evaluation of the 10 major technical areas is provided below.

1. LOW DISPERSIBLE MATERIAL (LDM)

In the 1996 Edition of TS-R-1, IAEA adopted additional requirements for transport of large quantities of radioactive material by air. These requirements established a limit of radioactivity that could be transported by air in a Type B package. For packages with a greater quantity, the radioactive material would either have to be non-dispersible under severe air crash conditions (low dispersible material), or the material must be transported in a package that was tested under air crash conditions (Type C package). Additional requirements were included in TS-R-1 to implement these changes, including Section IV (paragraph 416), Section VI (paragraphs 605, 663) and Section VII (paragraph 712), among others.

During the rulemaking process to harmonize with the 1996 IAEA standards, NRC evaluated the benefit of adopting the new provisions. NRC did not adopt the Type C package concept, including the restriction of quantity in a Type B package transported by air, the LDM definition and test requirements.

Compatibility Assessment: The Canada-U.S. Working Group Charter limits the current effort to Type B and Fissile Material Packages. Therefore, Type C packages are out of scope. However, according to IAEA and Canadian regulations, Type B packages may be certified to carry large quantities of radioactivity that is qualified as LDM. Since NRC regulations do not include the definition, tests, or applicability of LDM, this is identified as an incompatibility. Canadian regulations are more restrictive in that only Type B contents less than 3000 A_1 or 100,000 A_2 for material in special form or 3000 A_2 for material in normal form may be shipped by air, unless they are qualified as LDM.

Preliminary Conclusions: This incompatibility is judged to be unimportant. First, Type C packages are not in the working group scope. Second, the limits for transporting radioactive materials by air is an operational limit, and does not affect Type B package design. Third, CNSC can qualify material as LDM for use domestically, and a Type B package shipped by air from Canada would be acceptable to the U.S., since Part 71 and DOT regulations do not restrict the quantity of radioactivity transported in a Type B package by air. In addition, any international transport by air would necessarily comply with ICAO requirements. Based on these considerations, it is concluded that this incompatibility will not affect the joint package approval process.

2. INDUSTRIAL PACKAGES FOR FISSILE MATERIAL

In TS-R-1, the fissile material package standards are applied to any package type that contains greater than exempt quantities of fissile material. The package types could include Type C, Type B, Type A, or industrial packages (IP-1, IP-2, or IP-3). Therefore, a package could be designated as an IF package, as described in TS-R-1 Section VI (paragraphs 621 - 628) and Section VIII (paragraph 828). In Part 71, fissile material packages must meet either Type A or Type B standards, depending upon the quantity of radioactivity.

Compatibility Assessment: An industrial package for fissile material would still demonstrate that the contents always remain subcritical. The incompatibility arises in the containment requirements for the package. Under NRC regulations, any fissile material package that includes contents greater than a Type A quantity would have to meet the Type B release limits (71.51 and paragraph 656). Under Canadian regulations, a fissile material package that contains only low specific activity radioactive material would not need to meet paragraph 656, even if that total quantity of material exceeded a Type A quantity. This incompatibility may arise for materials such as unirradiated enriched uranium compounds. It is not clear if the containment requirements of 10 CFR 71.51 could be easily demonstrated for contents that have a very low radioactivity concentration.

Preliminary Conclusions: This incompatibility is judged to be unimportant. Canada does not have any certified Type IF designs, and none are anticipated. Most unirradiated uranium packages used in Canada are for domestic transport of unenriched or very low enriched uranium compounds for CANDU reactors. Canada would accept NRC certified Type AF packages, since the Type A requirements are more stringent than those for industrial packages.

3. PLUTONIUM BY AIR

NRC regulations include special provisions that apply to the transport of plutonium by air. The provisions include applicability (10 CFR 71.64) and special test requirements for air transport of plutonium (10 CFR 71.74). In addition, 10 CFR 71.63 requires plutonium to be in solid form for shipments exceeding 0.74 TBq (20 Ci).

Compatibility Assessment: Since IAEA and Canadian regulations have no equivalent requirements, this is identified as an area of incompatibility.

Preliminary Conclusions: Because of the limited applicability, this incompatibility is judged to be unimportant to the Working Group Charter.

4. CRUSH TEST

In the 1985 Edition of the IAEA regulations, the crush test was introduced for small, light, low-density packages that contain a large quantity of radioactivity (greater than 1000 A_2). In the 1996 Edition of TS-R-1, the applicability of the crush test was extended to small, light, low-density fissile material packages. NRC regulations also include the crush test as an accident condition, however, there are significant differences between the NRC and IAEA requirements. Specifically, NRC requires the crush test in addition to the 9-meter free drop test in the accident test sequence, whereas, TS-R-1 specifies the crush test in lieu of the free drop test for applicable packages.

The application of the crush test is fundamentally different between Canada and the U.S. The packages that must be evaluated for the crush test are identical, i.e., small, light packages (not greater than 500 kg), that are low density (not greater than 1000 kg/m^3), and that contain greater than 1000 A_2's or contain fissile material greater than exempt quantities. However, how the test is applied is different. Packages evaluated under TS-R-1 (paragraphs 656 and 682) are subjected to the crush test in lieu of the 9-meter free drop, whereas packages evaluated under Part 71 (71.73) are subjected to the crush test in addition and subsequent to the 9-meter drop test.

Compatibility Assessment: The application of the crush test is not compatible. In this instance, the NRC regulations are more restrictive than the IAEA regulations in that an additional test is required in the accident test sequence for the applicable packages.

Preliminary Conclusions: This is an area of incompatibility where the package design must

meet the most restrictive standard. However, there are so few packages that are subjected to the crush test that this incompatibility is considered to be unimportant.

5. FISSILE EXEMPTIONS

In the NRC regulations that became effective on October 1, 2004, the fissile material exemption standards were significantly revised. The revised regulations in 10 CFR 71.15, include several new exemption standards for low concentration fissile materials. In addition, the revised fissile material exemption standards include specific limits for certain moderating materials. The exemption standards in TS-R-1 (paragraph 672) are also included with minor differences in the revised 71.15.

Compatibility Assessment: There are significant differences in the fissile material exemption standards for the two countries. The U.S. regulations include certain exemptions that have not been adopted by either IAEA nor CNSC. The Canadian regulations are more restrictive than the U.S. regulations in this aspect. Material that can be shipped as "fissile exempt" in the U.S. may not be so designated in Canada.

Preliminary Conclusions: The line between fissile and fissile-exempt is not compatible. It is possible that packages that allow fissile material in exempt quantities (e.g., some Type B waste packages that may have small quantities of fissile material) may not be acceptable to CNSC. This is an area of incompatibility where the package design must meet the most restrictive standard. This is considered practical and not a significant burden. In addition, it is unlikely that this would affect any packages intended for import or export between Canada and the U.S.

6. DEEP WATER (200 M) IMMERSION TEST

An enhanced water immersion test was introduced in the 1985 Edition of the IAEA regulations for irradiated nuclear fuel packages. In the 1996 Edition of TS-R-1, this requirement was extended to Type B packages containing more than 10^5 A_2 (and Type C packages). The enhanced water immersion test conditions are specified in Paragraph 730. Paragraph 657 specifies that a Type B(U) package must be designed so that "if it were subjected to the enhanced water immersion test specified in paragraph 730, there would be no rupture of the containment system." NRC regulations adopted the enhanced water immersion test consistent with the IAEA requirements with respect to package applicability, i.e., it applies only to packages containing greater than 10^5 A_2 . However, the acceptance criterion is significantly different. NRC regulations in 10 CFR 71.61 specify that the package "must be designed so that its undamaged containment system can withstand an external water pressure of 2 MPa for a period of not less than 1 hour without collapse, buckling, or inleakage of water." The NRC regulations differ in that they specify that the package is undamaged, and that the containment system must withstand the pressure. The acceptance standards are different, i.e., TS-R-1 specifies "no rupture" of the containment system, and Part 71 specifies no "collapse, buckling, or inleakage of water."

These regulations are substantively different. It is judged that the Part 71 regulations are more restrictive than TS-R-1. For example, "no rupture" may be difficult to interpret. Failure of the containment system, or a design that allows the containment system to fail, would be acceptable under TS-R-1 if the failure is not considered "rupture." However, failure of the containment system would not be acceptable under Part 71.

Compatibility Assessment: This is a point of incompatibility for applicable packages.

Preliminary Conclusions: Because of the limited applicability, this may not be a significant incompatibility. In addition, most packages that are subject to the deep immersion test (e.g., spent fuel casks) are robust enough to withstand the external pressure without any failure of the containment system. Packages that are not robust enough to demonstrate this, or packages

that are designed to “fail gracefully” without rupture, may not be acceptable to the NRC. This is an area of incompatibility where the package design must meet the most restrictive standard. This is not considered a burden, and it is unlikely that this would affect any packages intended for import or export between Canada and the U.S.

7. ACCIDENT CONDITIONS TEST SEQUENCE

In TS-R-1, the order of the drop tests in the accident conditions test sequence (free drop, puncture and crush) is not specified. Rather, it is required that the order be justified, and that the order in which the package is tested shall be most damaging with respect to causing the most damage in the subsequent fire test. In Part 71, the order of the physical tests is specified, with the free drop followed by the crush (if applicable) followed by the puncture test.

Compatibility Assessment: This is a significant incompatibility. The intent is that the IAEA regulations are more restrictive, that is, the order must be justified as most damaging. Packages that have been tested simply by drop then puncture, without adequate justification, may not be acceptable to CNSC.

Preliminary Conclusions: NRC recognizes the difference in the sequencing. It has been judged by NRC that in practice the effects of the drop and puncture are always more damaging in the specified order. It has been NRC staff experience that packages evaluated under TS-R-1, where there is an uncertainty with respect to the order, have been tested as follows: puncture - drop - puncture. Although not required by the regulations, the performance of two puncture tests satisfies both regulations. It is judged not to be a significant burden for most package designs to include this demonstration. This is an area of incompatibility where the package design must meet the most restrictive standard.

8. BURNUP CREDIT FOR SPENT FUEL PACKAGES

Both NRC and IAEA regulations include requirements for the evaluation of subcriticality for irradiated fuel, taking into account the unknown parameters that affect system reactivity (e.g., paragraph 673 and 10 CFR 71.83). TS-R-1 includes an additional requirement in paragraph 674, that if the isotopic composition used is not determined to be the worst case during the irradiation history, that a measurement must be performed to confirm the conservatism of the isotopic composition. NRC regulations do not include this requirement.

Compatibility Assessment: TS-R-1 provides additional assurance with respect to criticality safety of spent fuel packages by requiring a measurement for assessments taking burnup credit. This may affect the criticality analyses performed in support of the certification of a spent fuel cask. Spent fuel casks that rely only on analysis without pre-shipment measurements may not be acceptable to CNSC.

Preliminary Conclusions: It is considered unlikely that any packages for use in both countries would be affected. Most spent fuel in Canada is low or unenriched, and burnup credit is not needed to demonstrate subcriticality. In a practical sense this incompatibility is not expected to present a problem. It may be a case where the most restrictive requirement would be met, i.e., for NRC-certified designs for use in Canada, a measurement would be needed. This is consistent with NRC regulatory guidance (e.g., Regulatory Guide 3.71) and Interim Staff Guidance issued by the Spent Fuel Project Office.

9. MODERATOR EXCLUSION

For fissile material packages, a single package must be critically safe assuming water can leak into the containment system (paragraph 677 and 10 CFR 71.55(b)). This is considered to be “non-mechanistic,” that is, the condition must be evaluated without regard to package performance in the immersion tests. The wording for the two regulations that address this

requirement are different, and are open to different interpretations. In addition, for arrays of damaged packages, the presence of water in the containment system must be assumed if the package testing resulted in water intrusion. The assumption of water inleakage is considered to be a fundamental safety parameter for preventing accidental criticality in transport. Therefore assuming that moderator is excluded from the package, either for the single package in isolation or for the damaged package arrays, is only permitted in certain, limited circumstances.

Compatibility Assessment: Although the regulations are similar, they are not identical, and the review practices may also be different. The review practices may need to be evaluated in detail, specifically with respect to the level of assurance needed to grant "moderator exclusion" for any fissile material package.

Preliminary Conclusions: It does not appear that there are philosophical differences between staffs at NRC and CNSC with respect to moderator exclusion. It is concluded that no packages would be affected.

10. GENERAL PACKAGE STANDARDS

There are a range of package standards that may present incompatibilities, for example: lifting and tie-down standards for packages, temperature and pressures used in package evaluations, potential for flammable gas generation, determination of maximum normal operating pressure, definition of confinement system for fissile material packages.

Compatibility Assessment: In reviewing the two sets of regulations it is clear that there are a significant number of provisions for general package standards that are not identical. These minor differences should be clearly identified and assessed in detail.

Preliminary Conclusions: Although there are many differences, it is judged that these differences do not significantly affect the design of Type B and fissile material packages, and that the review practices are, in general, compatible. Any guidance documents that are developed could identify these minor areas of incompatibility, and justify using the most restrictive requirements. It is a preliminary judgement that imposing these additional requirements would not be a significant regulatory burden. Therefore it is considered a preliminary conclusion that these differences would not pose a difficulty, and that the general approach would be for packages to meet the more restrictive requirements.