December 22, 2008

Mr. Anthony Patko
Director, Licensing
Engineering
NAC International
3930 East Jones Bridge Road, Suite 200
Norcross, GA 30092

SUBJECT: REVISION 50 OF CERTIFICATE OF COMPLIANCE NO. 9225 FOR THE MODEL NO. NAC-LWT PACKAGE

Dear Mr. Patko:

By letter dated August 12, 2008, as supplemented August 27, November 18, and December 4 and 10, 2008, NAC International (NAC) submitted a revised application in accordance with 10 CFR Part 71 for an amendment to Certificate of Compliance No. 9225 for the Model No. NAC-LWT package to incorporate ANSTO HIFAR fuel (either intact, degraded clad, and/or disassembled assemblies in different loading configurations). Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered users may request, by letter, to remove their names from the Registered Users List.

If you have any questions regarding this certificate, please contact me at (301) 492-3294 or Kim Hardin of my staff at (301) 492-3339.

Sincerely,
/RA/
Eric J. Benner, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9225
TAC No. L24243

Enclosures: 1. Certificate of Compliance No. 9225, Rev. No. 50
2. Safety Evaluation Report
3. Registered Users List

cc w/encls. 1& 2: R. Boyle, Department of Transportation
J. Shuler, Department of Energy
Registered Users

Mr. Anthony Patko
Director, Licensing
Engineering
NAC International
3930 East Jones Bridge Road, Suite 200
Norcross, GA 30092

December 22, 2008

SUBJECT: REVISION 50 OF CERTIFICATE OF COMPLIANCE NO. 9225 FOR THE MODEL NO. NAC-LWT PACKAGE

Dear Mr. Patko:

By letter dated August 12, 2008, as supplemented August 27, November 18, and December 4 and 10, 2008, NAC International (NAC) submitted a revised application in accordance with 10 CFR Part 71 for an amendment to Certificate of Compliance No. 9225 for the Model No. NAC-LWT package to incorporate ANSTO HIFAR fuel (either intact, degraded clad, and/or disassembled assemblies in different loading configurations). Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered users may request, by letter, to remove their names from the Registered Users List.

If you have any questions regarding this certificate, please contact me at (301) 492-3294 or Kim Hardin of my staff at (301) 492-3339.

Sincerely,
/RA/
Eric J. Benner, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9225
TAC No. L24243

Enclosures: 1. Certificate of Compliance No. 9225, Rev. No. 50
2. Safety Evaluation Report
3. Registered Users List

cc w/encls. 1& 2: R. Boyle, Department of Transportation
J. Shuler, Department of Energy
Registered Users

Distribution: Closes L24243
BWhite RBellamy,RI JMadera,RIII BSpitzberg,RIV DCollins,RII
via e-mail: PSaverot NOsgood MSampson CStaab MRahimi
Filename: G:\SFPO\PART 71 CASEWORK\9225.R50.LETTER&SER.wpd

OFC:	SFST	E	SFST		SFST		SFST		SFST	
NAME:	KHardin		MDebose		RParkhill		REinziger		ZLi	
DATE:	12/16/08		12/17/08		12/18/08		12/18/08		12/17/08	
OFC:	SFST	E	SFST		SFST		SFST		SFST	
NAME:	JPiotter		CRegan		MWaters		LCampbell		EBenner	
DATE:	12/17/08						12/17/08			

C = COVER E = COVER & ENCLOSURE N = NO COPY OFFICIAL RECORD COPY

SAFETY EVALUATION REPORT

Docket No. 71-9225
Model No. NAC-LWT Package
Certificate of Compliance No. 9225
Revision No. 50

SUMMARY

By letter dated August 12, 2008, as supplemented August 27, November 18, and December 4 and 10, 2008, NAC International (NAC or the applicant) requested a revision to Certificate of Compliance (CoC) No. 9225 for the Model No. NAC-LWT packaging. NAC requested the incorporation of the ANSTO HIFAR fuel as either intact, degraded clad, and/or disassembled assemblies in different loading configurations as authorized contents.

The approval of the ANSTO HIFAR contents are necessary to support the transport of additional foreign research reactor (FRR) fuel in support of the U.S. Department of Energy's National Nuclear Security Administration FRR fuel acceptance program.

Twenty-five NAC International Drawings were revised and one new drawing was added to update the CoC for this revision request and to incorporate changes due to several letter authorizations issued recently to accommodate minor fabrication difficulties identified by NAC.

By letter dated December 10, 2008, NAC submitted a consolidated Safety Analysis Report (SAR) that was utilized to finalize this revision.

Accordingly, CoC No. 9225 has been amended based on the statements and representations in the application, and staff agrees that the changes do not affect the ability of the package to meet the requirements of Title 10 of the Code of Federal Regulations (10 CFR) Part 71.

EVALUATION

The submittal was evaluated against the regulatory standards in 10 CFR Part 71, including the general standards for all packages, standards for fissile material packages, and performance standards under normal conditions of transport (NCT) and hypothetical accident conditions (HAC). Staff reviewed the application using the guidance in NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel."

Based on the statements and representations in the application, as supplemented, and the conditions listed in the CoC, the staff has reasonable assurance that the design has been adequately described and evaluated and meets the requirements of 10 CFR Part 71.

REFERENCES

NAC International, application dated December 10, 2008.

NAC International, supplements dated August 12 and 28, November 18, and December 4, 2008.

1.0 GENERAL INFORMATION

1.1 Package Description

The Model No. NAC-LWT package is shipped by truck, within an ISO container, or by railcar, as a Type B(U)F-96 package, as defined in 10 CFR 71.4. There were no changes to the package in this application.

1.2 Packaging Drawings

The applicant submitted twenty-five revised drawings. The revised drawings include:

LWT 315-40-02, Rev. 24 (Sheets 1-2)	Body Assembly
LWT 315-40-08, Rev. 18 (Sheets 1-5)	Cask Parts Detail
LWT 315-40-45, Rev. 5	42 MTR Element Base Module
LWT 315-40-46, Rev. 5	42 MTR Element Immediate Module
LWT 315-40-47, Rev. 5	42 MTR Element Top Module
LWT 315-40-49, Rev. 5	28 MTR Element Base Module
LWT 315-40-50, Rev. 5	28 MTR Element Intermediate Module
LWT 315-40-51, Rev. 5	28 MTR Element Top Module
LWT 315-40-70, Rev. 5	7 Cell Basket TRIGA Base Module
LWT 315-40-71, Rev. 5	7 Cell Basket TRIGA Intermediate Module
LWT 315-40-72, Rev. 5	7 Cell Basket TRIGA Top Module
LWT 315-40-80, Rev. 3	7 Cell Poison Basket TRIGA Base Module
LWT 315-40-81, Rev. 3	7 Cell Poison Basket TRIGA Intermediate Module
LWT 315-40-82, Rev. 3	7 Cell Poison Basket TRIGA Top Module
LWT 315-40-90, Rev. 3	35 MTR Element Module
LWT 315-40-91, Rev. 3	35 MTR Element Intermediate Module

LWT 315-40-92, Rev. 3	35 MTR Element Top Module
LWT 315-40-98, Rev. 4 (Sheets 1-3)	PWR/BWR Rod Transport Canister Assembly
LWT 315-40-100, Rev. 4 (Sheets 1-5)	Lids, PWR/BWR Rod Transport Canister
LWT 315-40-104, Rev. 4 (Sheets 1-3)	LWT Cask Assembly, PWR/BWR Rod Transport Canister
LWT 315-40-111, Rev. 2	LWT Transport Cask Assy DIDO Fuel
LWT 315-40-139, Rev. 1	Transport Cask Assembly, ANSTO Fuel
LWT 315-40-140, Rev. 1 (Sheets 1-2)	Weldment, 7 Cell Basket, Top Module, ANSTO Fuel
LWT 315-40-141, Rev. 1 (Sheets 1-2)	Weldment, 7 Cell Basket, Intermediate Module, ANSTO Fuel
LWT 315-40-142, Rev. 1 (Sheets 1-2)	Weldment, 7 Cell Basket, Base Module, ANSTO Fuel

The drawings were revised to incorporate changes due to several letter authorizations issued recently to accommodate minor fabrication difficulties identified by NAC and to support this revision.

The applicant submitted one new license drawing:

LWT 315-40-148, Rev. 0	LWT Transport Cask Assembly, ANSTO-DIDO Combination Basket

The drawing was added to incorporate the new ANSTO-DIDO combination basket.

1.3 Contents

The ANSTO HIFAR fuel includes ANSTO spiral (Mark III), MOATA plate (Mark II), and DIDO (Mark IV) fuel either intact, degraded clad, and/or disassembled assemblies. There are optional damaged fuel cans (DFCs) to facilitate handling of degraded clad or disassembled Mark II, III, and IV fuel elements. The requested loading combinations are described below.

- A mixed fuel load of up to 42 DIDO fuel elements and spiral and MOATA fuel assemblies in an ANSTO-DIDO combination basket consisting of a top ANSTO basket module, four intermediate DIDO basket modules, and one bottom DIDO basket module. Up to seven degraded clad DIDO, spiral, and/or MOATA fuel assemblies in DFCs or intact DIDO, spiral, and/or MOATA assemblies may be loaded in the top ANSTO module. The per element or DFC heat load limits for the top ANSTO module are: DIDO fuel element with or without DFC is 10 Watts; spiral fuel element in DFC is 10 Watts and 15.7 Watts without DFC; and MOATA fuel element in DFC is 1 Watt and 3 Watts without DFC. DIDO fuel elements loaded into intermediate and bottom basket modules are limited to ≤18 Watts. Maximum heat load per package is 753 Watts.

- A mixed fuel load of up to 42 spiral and MOATA fuel assemblies and DIDO fuel elements in an ANSTO basket. Degraded clad elements placed in DFCs or intact DIDO fuel elements are limited to loading in the top ANSTO basket module. Degraded clad spiral and MOATA fuel assemblies in DFCs are also limited to loading in the top ANSTO basket module. Maximum heat load per DIDO element is 10 Watts. Spiral fuel assemblies placed into DFCs are limited to a maximum of 10 Watts and MOATA plate bundles loaded in DFCs are limited to 1 Watt. Spiral fuel elements not placed in DFCs are limited to 15.7 Watts and MOATA plate bundles not placed in DFCs are limited to a maximum of 3 Watts with a minimum cool time of 10 years.

2.0 STRUCTURAL

The staff reviewed the application to revise the Model No. NAC-LWT package structural design and evaluation to assess whether the package will remain within the allowable values or criteria for normal conditions of transport (NCT) and hypothetical accident conditions (HAC) as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 2 (Structural Review) of NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel."

2.1 Structural Review Description

NAC has requested an approval for a revision to CoC No. 9225 to incorporate the ANSTO HIFAR fuel as either intact, degraded clad, and/or disassembled assemblies in different loading configurations as authorized contents.

The existing Safety Analysis Report (SAR), and NAC License Drawings were revised to reflect inclusion of these additional contents and submitted for the NRC staff review. No changes were made to the structural evaluation.

2.2 Material Properties

The request is to add degraded DIDO fuel (Mark IV), degraded ANSTO spiral fuel (Mark III) either as fuel elements or disassembled plates, and degraded MOATA fuel (Mark II) either as fuel elements or disassembled plates as approved contents all in damaged fuel cans for transport in the NAC-LWT cask. “Fuel elements” in this usage are equivalent to the normal usage of “fuel assemblies.” In addition, intact DIDO fuel elements were requested as approved contents in a different location in the cask. Since intact DIDO elements had been previously approved as contents, there are no materials concerns about these fuel elements and they were not evaluated. A definition of “degraded fuel” was provided.

All three types of fuel elements consist of a homogeneous mixture UAl alloy clad with aluminum plates. There could be up to 14 plates either flat or curved, depending on the assembly design, contained in an aluminum superstructure. The damaged fuel cans are made of 6061 aluminum and vented at both the top and bottom with screens. The bottom of the can is welded and the top of the can is screwed in place.

The damaged fuel cans or intact elements are placed in a 304 stainless steel basket. The basket materials, and weld specifications are noted on drawing 315-40-140. The welds are made according to ASME Sec IX, and visually inspected per ASME Sec V, Article 1 & 9. Weld acceptance is per Section III, NG-5360.

The cask has a 304 stainless steel body and closure lid. The inner and outer shells are XM-19 stainless steel. The cask has a lead (Pb) gamma shield and a borated ethylene glycol and water mixture neutron shield. Since the cask has previously been approved for transport, it will not be reevaluated. The neutron and gamma shield were evaluated to determine if they can withstand the maximum expected accident temperatures.

The three materials questions of concern are: 1) Interactions of the exposed fuel with other components, (Al +SS +UAl), 2) sufficient temperature margin for components during normal transport, and 3) containment source terms.

Interactions of the exposed fuel with other components, (Al +SS + UAl)

The main interaction concern reviewed is the generation of hydrogen during the corrosion of the aluminum if the cask cavity is not dried and a galvanic couple is set up between the aluminum cladding and the stainless steel in the basket. According to Section 7.1 of the SAR, if the package is loaded underwater, the cask cavity will be drained then vacuum dried before backfilling with helium. The cavity will be evacuated to 10 torr and held at that pressure for at least 10 minutes. If the pressure has not risen by more than 5 torr over the hold time, the cavity will be deemed dry. This procedure can be repeated if necessary. This drying method is acceptable to the staff for aluminum fuel. Using this drying procedure, no galvanic couples are expected to occur. The backfill should prevent oxidation of the aluminum to occur.

2.3 Structural Evaluation

The Staff has reviewed the NAC-LWT amendment request to add ANSTO HIFAR spent fuel configurations and noted that changes that were made in the package contents and subsequent mass are bounded by previous structural evaluations. In reviewing these changes, the staff found that the variations were minor and had no effect on the ability of the package to perform its safety function.

2.4 Conclusion

Based on the review of the application, the staff found reasonable assurance that the applicant has demonstrated that the NAC-LWT package for transport of the ANSTO HIFAR spent fuel meets the structural requirements for NCT and HAC as required by 10 CFR Part 71.

3.0 THERMAL

The staff reviewed the application to revise the Model No. NAC-LWT package thermal design and evaluation to assess whether the package temperatures will remain within their allowable values or criteria for NCT and HAC as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 3 (Thermal Review) of NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel."

3.1 Thermal Review Description

This amendment incorporates the addition of ANSTO HIFAR fuel [ANSTO (spiral), MOATA (plate) and DIDO (4 concentric plates)]. It also includes the addition of DFCs to contain and facilitate handling of degraded cladding or disassembled fuel elements for these fuel types. These fuels are transported in a new ANSTO-DIDO basket which includes six inline axial modules, with each module accommodating up to seven fuel assemblies for a total maximum number of 42 fuel assemblies per LWT cask. The top module near the loading end is dedicated to degraded fuel or disassembled fuel, loaded into DFCs, and the remaining modules accommodate intact DIDO or ANSTO fuel assemblies. Degraded fuel has been defined as fuel with failed cladding but will not result in formation of significant quantities of fuel debris during transport.

3.2 Thermal Evaluation

For the canned configurations, the applicant is lowering their heat load to compensate for the potential minimal increase in thermal resistance of the aluminum DFC. There are various configurations of fuel arrangements which were evaluated by the applicant and are discussed as follows:

- Degraded clad DIDO fuel will be placed in a DFC and loaded in the top module of an ANSTO-DIDO basket or standard ANSTO basket. The heat load for the degraded DIDO fuel will be limited to 10 Watts per fuel assembly versus 18 Watts in the original design basis of the ANSTO basket and versus 25 Watts in the original design basis of the DIDO basket. Since the applicant limits the maximum heat load of the non-DFC modules to 15.7 Watts and 18 Watts for the ANSTO and DIDO fuel, respectively, the original design basis will be maintained (for loading into the ANSTO-DIDO combination basket assembly).

- Intact DIDO fuel assemblies will be loaded in the top module of an ANSTO-DIDO basket or standard ANSTO basket. The heat load for the intact DIDO fuel will be limited to 10 Watts per fuel assembly versus 18 Watts in the original design basis of the ANSTO basket and versus 25 Watts in the original design basis of the DIDO basket. Since the applicant limits the maximum heat load of the non-DFC modules to 15.7 Watts and 18 Watts for the ANSTO and DIDO fuel, respectively, the original design basis will be maintained (for loading into the ANSTO-DIDO combination basket assembly).

- Degraded and disassembled ANSTO fuel assemblies will be placed in a DFC (1/2 of an assembly per DFC) and loaded in the top module of an ANSTO-DIDO basket or standard ANSTO basket. The heat load per DFC will be limited to 10 Watts. The original design basis heat loads for the ANSTO basket and the DIDO basket is 18 Watts per assembly and 25 Watts per assembly, respectively. The applicant states that these analyses bound this DFC loading of ANSTO fuel. The staff agrees that thermal loading will be bounding as long as the applicant limits the thermal input from the adjacent models to 18 Watts maximum, as indicated in SAR Sections 3.4.1.15.5 and 3.4.1.15.6.

- Degraded MOATA plates (disassembled assembly) will be placed in a DFC and loaded in the top module of an ANSTO-DIDO basket or standard ANSTO basket. The heat load limit will be 1 Watt which is bounded by the MOATA design basis heat load limit of 3 Watts. Based on the staff's evaluation, NAC revised Section 3.4.1.15, "Thermal Evaluation for ANSTO-DIDO Combination Basket," to clarify the thermal design basis of the subject basket. It appears that the 3 Watts limit per MOATA assembly is not based on an associated cladding temperature limit but rather a loading restriction for this fuel type. Since the cladding for the MOATA is aluminum, it has the same temperature limit as the other aluminum clad fuels which have higher heat loads. An analysis of the spiral aluminum clad ANSTO fuel, with an assembly heat limit of 15.7 Watts, for all modules loaded as such, resulted in a maximum cladding temperature of 250°F which bounds the lower heat load MOATA fuel loaded into a combination basket.

- Intact ANSTO fuel maximum heat load is limited to 15.7 Watts for all intact ANSTO fuel loaded into the ANSTO-DIDO combination basket assembly, except for within the DFC. The staff finds this acceptable since the original design basis heat load for ANSTO fuel is 18 Watts.

- DIDO fuel has a maximum heat load of 18 Watts loaded into any of the bottom 5 DIDO basket modules of the ANSTO-DIDO combination basket assembly. If loaded into the top module the heat load limit is 10 Watts per assembly whether it is intact or degraded. This configuration is bounded by the 25 Watts heat load per assembly used in the DIDO evaluation in Section 3.4.1.8.1.

Maximum temperatures of many cask components were calculated for each fuel and allowable atmosphere under normal and accident conditions of transport. The components of interest were: 1) Liquid neutron shield (ethylene glycol), 2) Outer and inner shields (stainless steel), 3) gamma shield (Pb), 4) basket (304 SS), and 5) fuel (UAl). The temperatures of the steels were too low to be of concern. The ethylene glycol was below the flash and boiling point, and the lead was well below the melting point. There were no temperature issues with these components. The creep of the aluminum and UAl components for the maximum was evaluated under its own deadload at both the normal and accident maximum temperature for the one year maximum transport duration and found to be minimal.

For the proposed fuel types included in the ANSTO-DIDO combination basket the applicant does not discuss specific temperatures of important to safety components, nor does it provide the staff of any safety margin that may be present. However, ample references are provided in the bounding analyses described elsewhere in the SAR to allow the reviewer to ascertain that material temperature limits are not being exceeded.

3.3 Conclusion

Based on the review of the application, the staff found reasonable assurance that the applicant has demonstrated that the NAC-LWT package for transport of the ANSTO HIFAR fuel meets the thermal requirements for NCT and HAC as required by 10 CFR Part 71.

4.0 CONTAINMENT

The staff reviewed the application to revise the Model No. NAC-LWT package to verify that the package containment design has been described and evaluated under NCT and HAC as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 4 (Containment Review) of NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel."

4.1 Containment System Design

The ANSTO HIFAR fuel will be transported in a leaktight containment boundary, which includes metallic containment seals on the closure lid and the Alternate B port covers for the vent and drain ports.

4.2 Containment Evaluation

Containment source terms

The DIDO containment analysis is used to bound the spiral and MOATA fuels. The containment analysis for the DIDO (SAR Section 4.5.7) and the similar aluminum MTR fuel (SAR Section 4.5.5) use the release fractions given in WSRC-TR-98-00317)[1] The release fractions given in this reference, Table 2, are the release fractions determined for LWR UO_2 based fuel with Zircaloy cladding. The document WSRC-TR-98-00317 provided some basis for using the release fractions developed for commercial LWR fuel for the UAl metallic alloy fuel. However, the staff did not agree sufficient information was provided to demonstrate that all the release fraction values for the LWR fuel bound those for the UAl fuel. Therefore, the application was revised to specify a leak-tight testing sensitivity of the containment boundary in accordance with ANSI-N14.5-1997. The following source term discussion explains the release fractions that were acceptable, and the reasons for not fully accepting all of the WSRC-TR-98-00317 release fractions for UAl fuel.

The fission gas release fraction is based on a trap-detrap mechanism coupled with diffusion of the gas through the matrix and or grain boundaries of the fuel. The trap-detrap part of the mechanism is difficult to model and evaluate and was assumed to contribute zero time to the gas release. The diffusion was modeled using the relative gas in a flat plate. A nominal value of 15% release was obtained in the reference. This value will depend though on the temperature of the plate, duration of the diffusion, and the use of the proper diffusion constant, i.e., bulk or grain boundary. None of these parameters are given in the reference to conclude if it is applicable to UAl fuel.

The values of the volatile release for both normal and accident transport condition are based on release measurements from irradiated UAl samples heated up to the melting point. The data was reasonable and sufficient to accept the values for the volatile release rates as given.

“Crud” is a colloquial term for corrosion and wear products (rust particles, etc.) that become radioactive (i.e., activated) when exposed to radiation and may deposit on nuclear fuel during reactor operations. The term “crud” in this case refers to the spallation of the oxide layer that forms when the fuel was in the reactor and storage pool and, subsequently, in a moist atmosphere in the cask. The value of this term was based on two fuel properties: the thickness of the oxide layer that is formed, and the spallation of this oxide layer. The corrosion is dependent on the quality of the water and can range from 1-2 microns over years in very good quality water to much thicker layers in poor quality water. At 200°C for some unknown period of time <3.7 microns of oxide was measured. The application did not specify the quality of the reactor or pool water, temperature that the fuel saw in these locations, or the time of residence. Therefore, the accuracy of the oxide layer calculations could not be verified. The oxide on the aluminum is very tenacious and has been experimentally verified to be vigorously scraped to be removed. The staff believes the 15% spallation may be an overestimate,

[1] DW Vinson, PS Blanton, RL Sindelar, and NC Iyer, “Bases for Containment Analysis for Transportation of Aluminum-Based Spent Nuclear Fuel,” Oct. 1998, WSRC-TR-98-00317

but quantitative data would be needed to justify a lower and more realistic value. The release fraction for the normal and accident conditions should be approximately the same.

A through-wall penetration and exposure of the fuel surface area is the mechanism need for fines release. Corrosion of this exposed area occurs while the fuel is in the reactor or, more likely, the pool, since the corrosion probably starts on handling scratches of the oxide layer formed in the reactor. The fines release fraction is dependent on three terms: the exposed fuel surface area, the depth of corrosion of the fuel, and the spallation of the corroded fuel. Since the exposed fuel meat is expected to behave the same as the exposed cladding, the formation of the corroded fuel and its spallation will be similar to that discussed above for the cladding oxide layer with the possible difference in time duration. The degraded and undamaged fuel is defined in the SAR (Table 1.1.1) as fuel having no more the 5% of the fuel meat surface area exposed.

In summary, the application did not provide sufficient basis for all the release fractions being applicable to aluminum based fuel with a UAl metallic alloy fuel meat. For these proposed contents, the staff does not endorse the WSRC-TR-98-00317 release fractions developed or measured for LWR fuel for use in containment analysis of aluminum based fuel, without additional supporting information and data. However, the applicant has specified testing the transportation cask to the leaktight criteria of ANSI 14.5-1997 for these requested contents. Based upon the specification to test the cask containment system to the leaktight criteria, and changing the casks configuration to support leaktight testing, the staff concludes that this amendment of the NAC-LWT meets the containment requirements for 10 CFR Part 71.

4.3 Conclusion

Based on the statements and representations in the application, staff agrees that the applicant has shown that the use of the NAC-LWT for transport of the ANSTO HIFAR fuel meets the requirements of 10 CFR Part 71 for the containment.

5.0 SHIELDING

The staff reviewed the application to revise the Model No. NAC-LWT package to verify that the shielding design has been described and evaluated under NCT and HAC, as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 5 (Shielding Review) of NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel."

5.1 Shielding Evaluation

For a previous licensing action (requested on April 17, 2006, and resulting in Revision 41 of Certificate of Compliance No. 9225), the applicant performed a shielding evaluation to show that the Spiral and MOATA fuel assemblies are bounded by the DIDO fuel assemblies listed in 5(b)(1)(x) of the certificate. For the current amendment, the applicant relied on this previous shielding analysis and provided a discussion to justify why the current amendment does not require a change in that previous analysis.

This discussion encompassed three areas. First, the ANSTO basket has slightly thicker tubes than the DIDO basket, so placing DIDO fuel in the ANSTO basket will not cause a higher dose rate. Second, the source for each payload type has not changed. Third, placing fuel into DFCs, especially given the lower heat load limits imposed, will have no adverse effects on dose rates.

5.2 Conclusion

Based on review of the statements and representations in the application, the staff concludes that the applicant has shown that the shielding design for the NAC-LWT containing the mixed ANSTO-DIDO payload configuration has been adequately described and evaluated and that the package meets the shielding requirements of 10 CFR Part 71.

6.0 CRITICALITY

The staff reviewed the application to revise the Model No. NAC-LWT package to verify that the criticality design has been described and evaluated under NCT and HAC, as required in 10 CFR Part 71. This application was also reviewed to determine whether the package fulfills the acceptance criteria listed in Section 6 (Criticality Review) of NUREG-1617, "Standard Review Plan for Transportation Packages for Spent Nuclear Fuel."

6.1 Criticality Design

The application for amendment to Certificate of Compliance No. 9225 requests permission to transport the following contents using the Model No. NAC-LWT:

1. Degraded-clad (damaged) DIDO fuels in Damaged Fuel Canister (DFC) loaded in an ANSTO top module,
2. Intact DIDO fuel element loaded in an ANSTO top module,
3. Degraded-clad spiral fuel elements (disassembled) in a DFC loaded into the top basket of ANSTO fuel module in the standard ANSTO basket assembly or in the top module of an ANSTO-DIDO combination basket assembly, and
4. Degraded-cladding MOATA plate elements (disassembled) in a DFC loaded into an ANSTO top basket of either a standard or ANSTO-DIDO combined module.

For these fuels, up to seven degraded-clad DIDO assemblies or spiral fuel assemblies, or MOATA plates in the DFC may be loaded in the top module of an NAC-LWT ANSTO/DIDO fuel package.

The applicant provided, in Chapter 6 of the revised Safety Analysis Report (SAR), a criticality safety evaluation for the packages with the requested contents.

6.2 Criticality Evaluation

Chapter 6 of the SAR provides criticality safety analyses for the DIDO fuel, ANSTO fuel with degraded clad, and mixed ANSTO/DIDO fuel packages. The maximum U-235 enrichment is 94 wt% for the DIDO HEU fuel, 92.0 wt% for MOATA fuel, and 95.0 wt% for the ANSTO spiral fuel. The transportation packages for uniform load of each of these fuel types/modules have previously been authorized except for the ANSTO spiral fuel, for which the cask was authorized for maximum enrichment of 85 wt% U-235. However, for the packages for 95 wt% enrichment ANSTO spiral fuel, the total U-235 weight per element is limited to 160 grams of U-235 per fuel element, which is the same as that of the 85 wt% enrichment fuel.

The applicant provided additional criticality safety analyses for the degraded-clad fuel and the mixed DIDO and ANSTO spent fuel transportation packages, with U-235 enrichment of 95 wt% for the ANSTO spiral fuel, under both NCT and HAC. The CSAS25 module of the SCALE 4.3 code system was used for the criticality analyses. Section 6.4.11 of the revised SAR provides discussion of the criticality safety evaluations for spent fuel transportation packages with various combinations of the DIDO and ANSTO fuels. Tables 6.4.11-1 through 6.4.11-7 provide the evaluation results for these packages. The most reactive configuration is the package with the combination of five DIDO baskets containing DIDO fuel and one top ANSTO fuel basket containing ANSTO spiral fuel or MOATA fuel plate with a 0.5326 cm plate pitch. The k_{safe} for this package is 0.8291. The Criticality Safety Index for this package is 0.0.

6.3 Conclusion

The staff reviewed the criticality safety analyses for the NAC-LWT ANSTO fuel package presented in the revised Safety Analysis Report. The staff also performed confirmatory analyses for the most reactive configuration using the CSAS25 module of the SCALE-5 code system with the 238 group cross section library.

Based on the results of its review and analyses, the staff concludes that the applicant has demonstrated with a reasonable assurance that the Model No. NAC-LWT package for mixed DIDO and ANSTO spent fuel with intact or degraded-clad elements continue to meet the criticality safety requirements of 10 CFR Part 71. The staff determined that transportation of previously approved fuel, but with degraded clad, does not impose a significant effect to the criticality safety assessment on these packages. The packages containing increased-enrichment (95 wt%) spiral fuels do not cause a significant change in the package reactivity because the total U-235 content per element is limited to be the same as that of the previously approved (85 wt%) spiral fuel. The most reactive package provides a bounding case for all requested DIDO/ANSTO packages.

7.0 PACKAGE OPERATIONS

Chapter 7 of the SAR provides procedures for package loading, unloading, and preparation of the empty package for transport. Sections 7.1.3, 7.1.4, 7.1.5, and 7.1.6 provide revised operating procedures for loading mixed DIDO and ANSTO spent fuel baskets into the NAC-LWT cask and procedures for loading damaged mixed DIDO and ANSTO fuel with degraded-clad into Damaged Fuel Cans. This included specification of using a cask tested to a leak-tight testing sensitivity in accordance with ANSI-N14.5-1997. Other minor changes were also made.

The staff reviewed the Operating Procedures in Chapter 7 of the SAR to verify that the package will be operated in a manner that is consistent with its design evaluation. On the basis of its evaluation, the staff concludes that the combination of the engineered safety features and the operating procedures provide adequate measures and reasonable assurance for safe operation of the proposed mixed DIDO and ANSTO spent fuel in accordance with 10 CFR Part 71. Further, the CoC is conditioned such that the package must be prepared for shipment and operated in accordance with the Operating Procedures specified in Chapter 7 of the Safety Analysis Report.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

The staff reviewed the revisions to Chapter 8 of the application to verify that the revised acceptance tests for the packaging meet the requirements of 10 CFR Part 71.

To support this revision request, Sections 8.1 and 8.2 of the SAR were revised to describe the requirements for acceptance testing and maintenance of the leaktight containment boundary.

Based on the statements and representations in the application, the staff concludes that the revised acceptance tests for the packaging meet the requirements of 10 CFR Part 71. Further, the CoC is conditioned to specify that each package must meet the Acceptance Tests and Maintenance Program of Chapter 8 of the application.

CONDITIONS

The CoC has been revised as follows:

Condition Nos. 5(a)(3)(i) and 5(a)(3)(ii):

> Twenty-five drawings were revised and one new drawing was added.

Condition No. 5(b)(1)(x):

> Details on the type and form of material were added for the additional contents of the degraded clad DIDO fuel.

Condition No. 5(b)(1)(xiv):

> Details on the type and form of material were added for the additional contents of the degraded clad ANSTO spiral and MOATA. The enrichment was changed for the ANSTO spiral fuel.

Condition No. 5(b)(2)(iv):

> Specifies the definition of the degraded clad MTR fuel.

Condition Nos. 5(b)(2)(xviii), 5(b)(2)(xi), and 5(b)(2)(xv):

> Provides for the maximum quantity of material per package for the additional contents of the ANSTO HIFAR fuel.

Condition Nos. 5(b)(vii)(a), 5(b)(vii)(b), 5(b)(viii), 5(b)(2)(xiii), 5(b)(2)(xvi), and 5(b)(2)(xviii):

> Editorial changes were made for clarity.

Condition No. 5(c):

> A mixed fuel load of DIDO and ANSTO fuel elements were added to the contents with a criticality safety index of 0.0.

Condition No. 6:

> The ANSTO HIFAR fuel was added to the condition.

Condition No. 9:

The leakage rate was corrected.

Condition Nos. 16 and 17:

These conditions were deleted because of redundancy. Additionally, the rest of conditions were renumbered.

Condition No. 18 (formerly numbered 20):

Allows the use of Revisions 48 and 49 of this certificate for one year.

CONCLUSION

Based on the statements and representations in the application, as supplemented, and the conditions listed above, the staff concludes that the Model No. NAC-LWT package design has been adequately described and evaluated and that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9225, Revision No. 50,
on December 22, 2008.