May 2, 2005

Mr. Patrick L. Paquin,
General Manager - Engineering and Licensing
Duratek
140 Stoneridge Drive
Columbia, SC 29210

SUBJECT: MODEL NO. CNS 10-160B TRANSPORTATION PACKAGE

Dear Mr. Paquin:

As requested by your application dated August 20, 2004, supplemented March 7 and April 8, 2005, enclosed is Certificate of Compliance No. 9204, Revision No. 10, for the Model No. CNS 10-160B package. Furthermore, the enclosed Certificate of Compliance No. 9204 Revision No. 10, incorporates the approval of the renewal request submitted to the NRC by your March 7, 2005, letter. This certificate supersedes, in its entirety, Certificate of Compliance No. 9204, Revision No. 9, dated July 23, 2004. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

The approval constitutes authority to use these packages for shipment of radioactive material and for the packages to be shipped in accordance with the provisions of 49 CFR 173.471. 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. 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 or Meraj Rahimi of my staff at (301) 415-8500.

Sincerely,
/RA/

Robert J. Lewis, Chief
Licensing Section
Spent Fuel Project Office
Office of Nuclear Material Safety
and Safeguards

Docket No.: 71-9204
TAC No.: L23761

Enclosures: 1. Certificate of Compliance No. 9204, Rev. No. 10
2. Safety Evaluation Report for CNS 10-160B

cc w/encl: R. Boyle, Department of Transportation
J. M. Shuler, Department of Energy
RAMCERTS
Registered Users

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SAFETY EVALUATION REPORT
Docket No. 71-9204
Model No. CNS 10-160B Package
Certificate of Compliance No. 9204
Revision No. 10

SUMMARY

By application dated August 20, 2004, as supplemented March 14 and April 8, 2005, Duratek requested an amendment to and renewal of Certificate of Compliance (CoC) No. 9204, Revision No. 9, for the Model No. CNS 10-160B package. The amendment request included the following changes:

1. Referencing previously approved Drawing C-119-B-0018, Rev. 2, in the CoC.
2. Allow 30-gallon (in addition to 55-gallon) payload containers to be loaded directly into CNS 10-160B package.
3. Allow presence of sealed inner containers with calculated hydrogen release rates.
4. Eliminate the requirement that all payload containers must have the same content code.
5. Addition of an option for using a site-specific shipping period shorter than 60 days in the gas generation analysis for the site's waste after review and approval of such requests.
6. Include remote-handled (RH) transuranic (TRU) waste from Idaho National Engineering and Environmental Laboratory (INEEL) as part of the authorized content.

Based on the statements and representations in the application, the staff agrees that the changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

1. GENERAL INFORMATION

The changes applicable to this section are related to the packaging, contents, and drawings. Changes with respect to each part of the package are listed and evaluated in the following sections.

1.1 Packaging

There are no proposed changes with respect to the packaging.

1.2 Contents

The following changes were proposed by the applicant with respect to the contents for the CNS 10-160B packaging.

1. Allow 30-gallon (in addition to 55-gallon) payload containers to be loaded directly into CNS 10-160B package.
2. Allow presence of sealed inner containers with calculated hydrogen release rates.
3. Eliminate the requirement that all payload containers must have the same content code.
4. Include RH-TRU waste from INEEL as part of the authorized content.

Although the above changes are related to the content, the applicant has addressed the changes in the containment section of the Safety Analysis Report (SAR). Therefore, the staff's evaluation of the above changes is presented in Section 4.

Effective October 1, 2004, Section 71.53 was replaced with Section 71.15. Therefore, the certificate was modified to reference Section 71.15 with respect to the fissile mass limit applying to CNS 10-160B in order to be exempt from compliance with the fissile material package standards of Section 71.55 and 71.59.

Conclusion

The applicant adequately described the amended contents of the Model No. TRUPACT-II package as required by 10 CFR 71.33(b). In addition, the applicant evaluated the amended contents with respect to potential for flammable gas generation, and the potential presence of flammable VOCs. The staff agrees with the applicant's conclusion that the package meets the requirements of 10 CFR Part 71 when the contents are limited as described in the CH-TRAMPAC document and related sections of the CH-TRU Payload Appendices document.

1.3 Drawings

Drawing No. C-119-B-0018, Rev. 2, had been reviewed and previously approved by the staff. However, CoC Revision 9 was still referencing Rev. 1 of the drawing. The change from Rev. 1 to Rev. 2 consisted of removing a copy protection clause from the drawing.

The staff agrees with previously approved change on the drawing and believes the applicant has provided sufficient information for staff's evaluation against 10 CFR Part 71.

2. STRUCTURAL

No changes were made to the structural section of the SAR.

3. THERMAL

No changes were made to the thermal section of the SAR.

4. CONTAINMENT

The applicant requested a number of modifications to Appendix 4.10.2, from the original CNS 10-160B SAR, and provided a new sub tier Appendix 4.10.2-5, so that a new set of site-specific waste content codes can be added to the Approved Contents List.

Appendix 4.10.2

The applicant identified the following modifications to the current version of Appendix 4.10.2:

1. Allow 30-gallon (in addition to the currently approved 50-gallon) drums to be directly loaded into the CNS 10-160B cask. Up to 10 drums (30- or 50-gallon) can be accommodated inside the transportation package.

The staff agrees with this proposed amendment provided the precautionary and appropriate measures are taken in order to guarantee the shoring of every payload container, as described in Section 7.1.6 of the SAR, in order to prevent the movement during accident conditions.

2. Allow the presence of sealed inner containers with calculated hydrogen release rates.

The staff agrees with this proposed amendment provided sealed containers (e.g., rigid plastic containers, plastic bags) greater than 4 liters in volume that do not have a known, measured, or calculated hydrogen release rate or resistance are prohibited as stated in Section 4.0 of Appendix 4.10.2 of the SAR.

3. Eliminate the requirement that all payload containers must have the same content code.

The staff agrees with the proposed amendment provided the waste is originated from the same laboratory site and approved under the same sub tier Appendix as indicated in Section 10.4 of Appendix 4.10.2. Furthermore, as indicated in Section 10.5 of Appendix 4.10.2, the decay heat limit and the hydrogen gas generation limit for all loaded containers must be assumed to be the same as that of the payload container with the lowest decay heat limit and hydrogen gas generation rate limit, respectively.

4. Addition of an option for using a site-specific shipping period shorter than 60 days in the gas generation analysis for the site's waste.

The staff agrees with the proposed amendment provided the request is submitted to the NRC for review and approval as indicated in Section C.4.0 of Attachment C of Appendix 4.10.2 of the SAR. This option is currently not being exercised for the CNS 10-160B cask but has been used/approved for a different transportation cask (TRUPACT/HalfPACT). The staff reinforces the fact that a 60 day shipping period provides a strong safety margin argument for the approval of any proposed payload. The reduction in shipping time must be accompanied by a well presented application where other sources of conservatism are clearly indicated and evaluated. The staff recommends the reading of its evaluation of sub tier Appendix 4.10.2-5 .

5. Include RH-TRU waste from INEEL as part of the authorized content, as described in sub tier Appendix 4.10.2-5.

The staff's comments on this proposed amendment follows.

Sub Tier Appendix 4.10.2-5

The applicant requested inclusion of the RH-TRU waste (identified as content codes ID 322A, ID 322B, ID 325A, or ID 325B) from INEEL to the list of Approved Contents for the CNS 10-160B. These content codes apply to approximately 620 30-gallon drums of waste, currently at the INEEL, resulting from the destructive and non-destructive examination of radiological materials such as fuel pins, reactor structural materials and targets in the Argonne National Laboratory-East (ANL-E) Alpha Gamma Hot Cell Facility between 1971 and 1995. Attachment A to sub tier Appendix 4.10.2-5 of the application clearly describes these four content codes, including the packaging details and list of chemical constituents.

Inside each 30-gallon drum the waste is packaged in the following order: two 7.5 gallon metal cans, a fiber-board bag spreader, a heat-sealed PVC bag (with or without a filter vent), a polyethylene drum liner, and finally another heat-sealed PVC bag (with or without a filter vent). The 30-gallon drum is also vented, either through a filter or an opening in the drum lid. The 30-gallon drum may be directly placed inside the CNS 10-160B cask or inserted into a filter vented 55-gallon drum which is then placed inside the CNS 10-160B transportation cask. Up to 10 drums (30- or 55-gallon) can be accommodated inside the CNS 10-160B cask. Payload containers of different content codes may be loaded into the 10-160B cask as long as the decay heat limit and the hydrogen gas generation limit for all loaded containers are conservatively assumed to be the same as that of the payload container with the lowest decay heat limit and hydrogen gas generation rate limit.

The following thermal characteristics are required from a 30-gallon drum prior to loading for transportation:

Table 1: Allowable Limits

		Dose #0.012 watt.year		Dose > 0.012 watt.year	
Content Code	Hydrogen Gas Generation Rate Limit per Drum (mol/s)	Decay Heat Limit per Drum (watts)	Decay Heat Limit per Cask (watts)	Decay Heat Limit per Drum (watts)	Decay Heat Limit per Cask (watts)
ID 322A	3.61E-9	3.26E-2	3.26E-1	1.17E-1	1.17E-0
ID 322B	3.28E-8	2.97E-1	1.81E-1	1.02E-0	2.28E-0
ID 325A	3.61E-9	6.48E-3	6.48E-2	2.35E-2	2.35E-1
ID 325B	3.28E-8	5.94E-2	5.94E-1	2.06E-1	2.06E-0

It is important to highlight the fact that, for content code ID 322B, the decay heat limit per cask is not equal to 10 times the decay heat limit per drum for both dose-independent and dose-dependent conditions, due to internal pressure limit considerations.

Based on process the knowledge (also referred to as acceptable knowledge) about the waste and its generation processes, the applicant indicates that the requirements (as stated in Appendix 4.10.2 of the application) for physical and chemical forms as well as chemical compatibility are met for the four proposed waste content codes.

The CNS 10-160B cask payload may contain fissile materials as long as the 10 CFR §71.15 limits are not exceeded and the Plutonium content is not above 0.74 Tbq (20 curies) per cask. Based on process knowledge or direct measurement, the content of each proposed payload container must be determined/justified so that these fissile exempt restrictions can be fulfilled.

The internal pressure buildup during transportation is conservatively estimated by assuming a shipping period of 365 days and considering a cellulosic waste medium (presenting the highest

$G_{net\ gas}$ value of 10.2 molecules/100eV at 70EF as shown in Table 3.1-24 of CH-TRU Payload Appendix 3.1, Rev. 0). The gas production is evaluated at the maximum operating temperature of 168EF, with gas thermal expansion as well as water vapor pressure also taken into account. The minimum internal void space is achieved when the 10-160B cask is loaded with ten 50-gallon drums. Except for content code ID 322B, the calculated internal pressures do not reach the design limit of 31.2 psig. In order to allow loading of ID 322B waste, the "per cask" decay heat limit is therefore lowered as shown in the Table 1 above.

The hydrogen gas generation rate limits are derived by first identifying all the internal (secondary) containers that may be present inside the 10-160B cask and their associated resistance to the passage of hydrogen. The 7.5 gallon drums and the rigid polyethylene liner must have openings that are equivalent to or larger than a 0.3-inch diameter hole. The fiber-board bag spreader must be open at both ends. In the case of heat-sealed bags, the permeation of hydrogen through the PVC material is taken into account by considering the temperature effect as well as the available area of the bag, its thickness and internal pressure. The remaining secondary filtered containers must have at least one filter vent with a minimum allowable hydrogen diffusivity as listed in the Table that follows:

Table 2: Hydrogen Diffusivity

Container Type	Minimum Flow Rate (mL/Min air, STP, inch water)[a]	Efficiency (percent)	Hydrogen Diffusivity @ 25EC (mol/s/mol fraction)
30-gallon drum	35	> 99.9	3.70E-6
55-gallon drum	35	> 99.9	3.70E-6
filtered bag	35	N/A[b]	1.075E-5

a. Filters tested at a different pressure shall have a proportional flow rate.

b. Not applicable.

It is important to mention that any internal sealed container greater than four liters in volume must have a known, measured, or inferred hydrogen release rate. The applicant has indicated that, through process knowledge, none of the contents internal to the 7.5 gallon drums fall under this category.

By conservatively assuming all internal contents and containers at steady-state and at a pressure of 1 atmosphere, the hydrogen generation rate that guarantees that the inner most container will not reach a hydrogen molar concentration of 5% after 60 days of shipping can be deduced. From this value, the decay heat limit is derived based on the appropriate use of dose-dependent or dose-independent G values (released molecules/absorbed 100 eV), depending on the waste age and decay heat.

In case the estimated decay heat for a given drum exceeds the allowable decay heat limit, it is possible for this drum still to be shipped if the hydrogen gas generation can be demonstrated to be less than the limit specified in Table 1 above. By directly measuring the hydrogen concentration in the drum headspace and applying/solving the proper balance equations, a more specific hydrogen gas generation rate can be calculated. It is important to mention,

however, that the decay heat limits per cask still apply and must be obeyed, since they are directly related to internal pressure calculations.

The staff independently reproduced/verified most of the results presented by the applicant. In large part, the suggested values and processes agree very closely with what is also currently used for the approved applications dealing with the transportation of contact-handled TRU waste with TRUPACT/HalfPACT packages. The staff recognizes the significant margins of safety brought in by assuming 1 full year transportation time for calculating internal pressure limits and 60 days shipping time for deriving hydrogen gas generation limits. However, the staff would like to mention that by deriving release rates at 20EF and using G values estimated at 168EF may not yield the most limiting decay heat limits at all instances. A more appropriate approach would be to assume the temperature-dependence of all involved factors, very much like what is discussed in Appendix 6.9 of CH-TRU Payload Appendices, Rev. 0 .

In summary, the staff agrees with the hydrogen generation rate and decay heat limits proposed for the RH-TRU waste containers from INEEL to be added to the approved list of contents for the CNS 10-160B transportation cask.

5. SHIELDING

The applicant revised the shielding analysis for the Model No. 10-160B to determine the external dose rate due to RH-TRU waste stored at INEEL. This waste consists of 30-gallon drums of RH-TRU waste generated during irradiated fuel examination at ANL-E. The expected radionuclide content for 10 drums of this waste is given in Table A-2 of Appendix 5.6.1 of the SAR. The source term used in the shielding analysis was developed from the expected value of these radionuclides plus three times the measurement uncertainty. The individual photon characteristics for the gamma source is given in Table A-3, and the neutron source due to spontaneous fission and α,n reactions is given in Table A-4.

Under normal conditions of transport, the source volume was modeled as an annular cylinder roughly the dimensions of a circular array of 5 30-gallon drums stacked 2 high. The mass of the waste, drum walls, and source radionuclides were modeled as uniformly distributed throughout the annulus. The mass of the various layers of confinement containing the waste (e.g., metal cans, PVC bags) were conservatively neglected. Under hypothetical accident conditions, the waste was modeled as a disc, with a density 10 times that of the normal conditions of transport model, compressed against the bottom of the cask cavity.

The applicant calculated external gamma and neutron dose rates at various radial and axial distances from the cask surface using the SAS4 sequence of the SCALE computer code. Neutron dose rates were shown to be negligible compared to gamma dose rates. The resulting external dose rates are summarized in Table A-8 of Appendix 5.6.1 of the SAR, and in the following table:

Table 1: 10-160B Maximum External Dose Rates (mrem/hr (mSv/hr))

Normal Conditions of Transport	Package Surface			2 meters From Vehicle
	Top	Side	Bottom	Side
	0.46(0.0046)	2.8 (0.028)	0.46 (0.0046)	0.27 (0.0027)
Hypothetical Accident Conditions	1 Meter from Package Surface			N/A
	Top	Side	Bottom	
	1.1 (0.011)	0.38 (0.0038)	1.1 (0.011)	

Note that the resulting dose rates are several orders of magnitude below the external radiation standards of 10 CFR 71.47(b) for normal conditions of transport, and §71.51(a)(2) for hypothetical accident conditions.

The staff performed a confirmatory analysis of the applicant's calculated external gamma dose rates using the MicroShield 5 point kernel gamma dose rate code. Using conservative material and geometry approximations, the staff calculated external gamma dose rates that confirmed those calculated by the applicant.

The applicant has shown and the staff agrees that the Model No. 10-160B, loaded with RH-TRU waste from INEEL as described in Appendix 5.6.1 of the SAR, meets the external dose rate requirements 10 CFR Part 71.

No other changes were made to any other parts of the SAR.

CONDITIONS

Condition No. 10(a) of the certificate was revised to clarify that the package is approved for use under the provisions of 10 CFR 71.14(b)(3)(I) for low specific activity material or surface contaminated objects. This change is due to a revision in the numbering of the sections in 10 CFR Part 71, that became effective on October 1, 2004 (69 FR 3698).

Condition 11(c)(2) of the certificate was modified to reference specifically the approved compliance methodologies for each of the authorized transuranic waste sources.

Condition No. 12 of the certificate was revised to clarify that the package is approved for use under the general license provisions of 10 CFR 71.17. This change is due to a revision in the numbering of the sections in 10 CFR Part 71, that became effective on October 1, 2004 (69 FR 3698).

Condition No. 13 of the certificate was revised to renew the certificate of compliance for an additional five years.

CONCLUSION

The Certificate of Compliance has been revised to reference Revision No. 19 of the SAR with associated changes. The changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9204, Revision No. 10, on May 2, 2005 .