

**CERTIFICATE OF COMPLIANCE  
FOR RADIOACTIVE MATERIAL PACKAGES**

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
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## 2. PREAMBLE

- a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."
- b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

## 3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

- |   |   |
|---|---|
| <p>a. ISSUED TO (<i>Name and Address</i>)</p> <p>NAC International<br/>3930 East Jones Bridge<br/>Norcross, Georgia 30092</p> | <p>b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION</p> <p>NAC International, Inc. application dated<br/>December 30, 1996, as supplemented</p> |
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## 4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

## 5.

## (a) Packaging

- (1) Model No.: NAC-STC
- (2) Description: For descriptive purposes, all dimensions are approximate nominal values. Actual dimensions with tolerances are as indicated on the Drawings.

A steel, lead and polymer (NS4FR) shielded shipping cask for (a) directly loaded irradiated PWR fuel assemblies, (b) intact, damaged and/or the fuel debris of Yankee Class or Connecticut Yankee irradiated PWR fuel assemblies in a canister, and (c) non-fissile, solid radioactive materials (referred to hereafter as Greater Than Class C (GTCC) as defined in 10 CFR Part 61) waste in a canister. The cask body is a right circular cylinder with an impact limiter at each end. The package has approximate dimensions as follows:

Cavity diameter	71 inches
Cavity length	165 inches
Cask body outer diameter	87 inches
Neutron shield outer diameter	99 inches
Lead shield thickness	3.7 inches
Neutron shield thickness	5.5 inches
Impact limiter diameter	124 inches
Package length:	
without impact limiters	193 inches
with impact limiters	257 inches

The maximum gross weight of the package is about 260,000 lbs.

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5.(a)(2) Description (Continued)

The cask body is made of two concentric stainless steel shells. The inner shell is 1.5 inches thick and has an inside diameter of 71 inches. The outer shell is 2.65 inches thick and has an outside diameter of 86.7 inches. The annulus between the inner and outer shells is filled with lead.

The inner and outer shells are welded to steel forgings at the top and bottom ends of the cask. The bottom end of the cask consists of two stainless steel circular plates which are welded to the bottom end forging. The inner bottom plate is 6.2 inches thick and the outer bottom plate is 5.45 inches thick. The space between the two bottom plates is filled with a 2-inch thick disk of a synthetic polymer (NS4FR) neutron shielding material.

The cask is closed by two steel lids which are bolted to the upper end forging. The inner lid (containment boundary) is 9 inches thick and is made of Type 304 stainless steel. The outer lid is 5.25 inches thick and is made of SA-705 Type 630, H1150 or 17-4PH stainless steel. The inner lid is fastened by 42, 1-1/2-inch diameter bolts and the outer lid is fastened by 36, 1-inch diameter bolts. The inner lid is sealed by two metallic O-rings. The outer lid is equipped with a single metallic O-ring. The inner lid is fitted with a vent and drain port which are sealed by metallic O-rings and cover plates.

The cask body is surrounded by a 1/4-inch thick jacket shell constructed of 24 stainless steel plates. The jacket shell is 99 inches in diameter and is supported by 24 longitudinal stainless steel fins which are connected to the outer shell of the cask body. Copper plates are bonded to the fins. The space between the fins is filled with NS4FR shielding material.

Four lifting trunnions are welded to the top end forging. The package is shipped in a horizontal orientation and is supported by a cradle under the top forging and by two trunnion sockets located near the bottom end of the cask.

The package is equipped at each end with an impact limiter made of redwood and balsa. Two impact limiter designs consisting of a combination of redwood and balsa wood, encased in Type 304 stainless steel are provided to limit the g-loads acting on the cask during an accident. The predominately balsa wood impact limiter is designed for use with all the proposed contents. The predominately redwood impact limiters may only be used with directly loaded fuel or the Yankee-MPC configuration.

The contents are transported either directly loaded (uncanistered) into a stainless steel fuel basket or within a stainless steel transportable storage canister (TSC). The TSC, including its welded shield and structural lids, represents the separate inner container for the purposes of meeting 10 CFR 71.63.

The directly loaded fuel basket within the cask cavity can accommodate up to 26 PWR fuel assemblies. The fuel assemblies are positioned within square sleeves made of stainless steel. Boral sheets are encased outside the walls of the sleeves. The sleeves are laterally supported by 31, 1/2-inch thick, 71-inch diameter stainless steel disks. The basket also has 20 heat transfer disks made of Type 6061-T651 aluminum alloy. The support disks and heat transfer disks are connected by six, 1-5/8-inch diameter by 161-inch long threaded rods made of Type 17-4 PH stainless steel.

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5.(a)(2) Description (Continued)

The TSC shell, bottom plate, and welded shield and structural lids are fabricated from stainless steel. The bottom is a 1-inch thick steel plate, and the shell is constructed of 5/8-inch thick rolled steel plate and is 70 inches in diameter. The shield lid is a 5-inch thick steel plate and contains drain and fill penetrations for the canister. The structural lid is a 3-inch thick steel plate. The canister contains a stainless steel fuel basket that can accommodate up to 36 intact Yankee Class fuel assemblies and Reconfigured Fuel Assemblies (RFAs), or up to 26 intact Connecticut Yankee fuel assemblies with RFAs, with a maximum weight limit of 35,100 lbs. Alternatively, a stainless steel GTCC waste basket is used for up to 24 containers of waste.

One TSC fuel basket configuration can store up to 36 intact Yankee Class fuel assemblies or up to 36 RFAs within square sleeves made of stainless steel. Boral sheets are encased outside the walls of the sleeves. The sleeves are laterally supported by 22 1/2-inch thick, 69-inch diameter stainless steel disks, which are spaced about 4 inches apart. The support disks are retained by split spacers on eight 1.125-inch diameter stainless steel tie rods. The basket also has 14 heat transfer disks made of Type 6061-T651 aluminum alloy.

The second fuel basket is designed to store up to 26 Connecticut Yankee Zirc-clad assemblies enriched to 3.93 wt. percent, stainless steel clad assemblies enriched up to 4.03 wt. percent, RFAs, or damaged fuel in CY-MPC damaged fuel cans (DFCs). Zirc-clad fuel enriched to between 3.93 and 4.61 wt. percent, such as Westinghouse Vantage 5H fuel, must be stored in the 24-assembly basket. Assemblies approved for transport in the 26-assembly configuration may also be shipped in the 24-assembly configuration. The construction of the two basket configurations is identical except that two fuel loading positions of the 26-assembly basket are blocked to form the 24-assembly basket.

RFAs can accommodate up to 64 Yankee Class fuel rods or up to 100 Connecticut Yankee fuel rods, as intact or damaged fuel or fuel debris, in an 8x8 or 10x10 array of stainless steel tubes, respectively. Intact and damaged Yankee Class or Connecticut Yankee fuel rods, as well as fuel debris, are held in the fuel tubes. The RFAs have the same external dimensions as a standard intact Yankee Class, or Connecticut Yankee fuel assembly.

The TSC GTCC basket positions up to 24 Yankee Class or Connecticut Yankee waste containers within square stainless steel sleeves. The Yankee Class basket is supported laterally by eight 1-inch thick, 69-inch diameter stainless steel disks. The Yankee Class basket sleeves are supported full-length by 2.5-inch thick stainless steel support walls. The support disks are welded into position at the support walls. The Connecticut Yankee GTCC basket consists of GTCC waste containers supported full length by a 1.75-inch thick shell, which is laterally supported by twelve welded 1.25-inch thick outer ribs. The GTCC waste containers accommodate radiation activated and surface contaminated steel, cutting debris (dross) or filter media, and have the same external dimensions of Yankee Class or Connecticut Yankee fuel assemblies.

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5.(a)(2) Description (Continued)

The Yankee Class TSC is axially positioned in the cask cavity by two aluminum honeycomb spacers. The spacers, which are enclosed in a Type 6061-T651 aluminum alloy shell, position the canister within the cask during normal conditions of transport. The bottom spacer is 14- inches high and 70-inches in diameter, and the top spacer is 28-inches high and also 70-inches in diameter.

The Connecticut Yankee TSC is axially positioned in the cask cavity by one stainless steel spacer located in the bottom of the cask cavity.

5.(a)(3) Drawings

(i) The cask is constructed and assembled in accordance with the following Nuclear Assurance Corporation (now NAC International) Drawing Nos.:

423-800, sheets 1-2, Rev. 6	423-811, sheets 1-2, Rev. 5
423-802, sheets 1-6, Rev. 12	423-812, Rev. 2
423-803, Rev. 1	423-900, Rev. 5
423-804, sheets 1-3, Rev. 2	423-209, Rev. 0
423-805, Rev. 1	423-210, Rev. 0
423-806, Rev. 1	423-901, Rev. 2
423-807, sheets 1-2, Rev. 1	

(ii) For the directly loaded configuration, the basket is constructed and assembled in accordance with the following Nuclear Assurance Corporation (now NAC International) Drawing Nos.:

423-870, Rev. 2  
423-871, Rev. 1  
423-872, Rev. 3  
423-873, Rev. 1  
423-874, Rev. 2  
423-875, sheets 1-2, Rev. 3

(iii) For the Yankee Class TSC configuration, the canister, and the fuel and GTCC waste baskets are constructed and assembled in accordance with the following NAC International Drawing Nos.:

455-800, sheets 1-2, Rev. 2	455-887, sheets 1-3, Rev. 4
455-801, sheets 1-2, Rev. 3	455-888, sheets 1-2, Rev. 6
455-820, Rev. 1	455-891, sheets 1-2, Rev. 1
455-870, Rev. 4	455-892, sheets 1-2, Rev. 2
455-871, sheets 1-2, Rev. 6	455-893, Rev. 3
455-872, sheets 1-2, Rev. 9	455-894, Rev. 2
455-873, Rev. 3	455-895, sheets 1-2, Rev. 4
455-881, sheets 1-3, Rev. 6	

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5.(a)(3) Drawings (Continued)

(iv) For the Yankee Class TSC configuration, RFAs are constructed and assembled in accordance with the following Yankee Atomic Electric Company Drawing Nos.:

YR-00-060, Rev. 1	YR-00-064, Rev. 1
YR-00-061, Rev. 1	YR-00-065, Rev. 1
YR-00-062, Rev. 1	YR-00-066, Rev. 1
YR-00-063, Rev. 1	

(v) The Balsa Impact Limiters are constructed and assembled in accordance with the following NAC International Drawing Nos.:

423-257, Rev. 2  
423-258, Rev. 2  
423-843, Rev. 2  
423-859, Rev. 0

(vi) For the Connecticut Yankee TSC configuration, the canister and the fuel and GTCC waste baskets are constructed and assembled in accordance with the following NAC International Drawing Nos.:

414-801, sheets, 1-2, Rev. 1	414-891, Rev. 3
414-820, Rev. 0	414-892, sheets 1-3, Rev. 3
414-870, Rev. 2	414-893, sheets, 1-2, Rev. 2
414-871, sheets 1-2, Rev. 2	414-894, Rev. 0
414-872, sheets 1-2, Rev. 2	414-895, sheets 1-2, Rev. 3
414-873, Rev. 0	
414-881, sheets 1-2, Rev. 3	
414-882, sheets 1-2, Rev. 3	
414-887, sheets 1-4, Rev. 3	
414-888, sheets 1-2, Rev. 3	
414-889, sheets 1-2, Rev. 3	

vii) For the Connecticut Yankee TSC configuration, DFCs and RFAs are constructed and assembled in accordance with the following NAC International Drawing Nos.:

414-901, Rev. 0  
414-902, sheets 1-2, Rev. 1  
414-903, sheets 1-2, Rev. 1  
414-904, sheets 1-3, Rev. 0

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5.(b) Contents

(1) Type and form of material

(i) Irradiated PWR fuel assemblies with uranium oxide pellets. Each fuel assembly may have a maximum burnup of 40,000 MWD/MTU when cooled for at least 6.5 years, or 45,000 MWD/MTU when cooled for at least 10 years. The maximum heat load per assembly is 850 watts. Prior to irradiation, the fuel assemblies must be within the following dimensions and specifications:

Assembly Type	14x14	15x15	16x16	17x17	17x17 (OFA)
Cladding Material	Zirc-4	Zirc-4	Zirc-4	Zirc-4	Zirc-4
Maximum Initial Uranium Content (kg/assembly)	407	469	426	464	426
Maximum Initial Enrichment (wt% <sup>235</sup> U)	4.2	4.2	4.2	4.2	4.2
Minimum Initial Enrichment (wt% <sup>235</sup> U)	3.7	3.7	3.7	3.7	3.7
Assembly Cross-Section (in)	7.76 to 8.11	8.20 to 8.54	8.10 to 8.14	8.43 to 8.54	8.43
Number of Fuel Rods per Assembly	★ 176 to 179	★ 204 to 216	236	264	264
Fuel Rod OD (in)	0.422 to 0.440	0.418 to 0.430	0.382	0.374 to 0.379	0.360
Minimum Cladding Thickness (in)	0.023	0.024	0.025	0.023	0.023
Pellet Diameter	0.344 to 0.377	0.358 to 0.390	0.325	0.3225 to 0.3232	0.3088
Maximum Active Fuel Length (in)	146	144	150	144	144

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5.(b)(1) Contents - Type and Form of Material (Continued)

(ii) Irradiated intact Yankee Class PWR fuel assemblies or RFAs within the TSC. The maximum initial fuel pin pressure is 315 psig. The fuel assemblies consist of uranium oxide pellets with the specifications, based on design nominal or operating history record values, listed below:

Assembly Manufacturer/Type	UN 16x16	CE <sup>(1)</sup> 16x16	West. 18x18	Exxon <sup>(2)</sup> 16x16	Yankee RFA
Cladding Material	Zircaloy	Zircaloy	SS	Zircaloy	Zirc/SS
Maximum Number of Rods per Assembly	237	231	305	231	64
Maximum Initial Uranium Content (kg/assembly)	246	240	287	240	70
Maximum Initial Enrichment (wt% <sup>235</sup> U)	4.0	3.9	4.94	4.0	4.94
Minimum Initial Enrichment (wt% <sup>235</sup> U)	4.0	3.7	4.94	3.5	3.5
Maximum Assembly Weight (lbs)	850	850	900	850	850
Maximum Burnup (Mwd/MTU)	32,000	36,000	32,000	36,000	36,000
Maximum Decay Heat per Assembly (kW)	0.28	0.347	0.28	0.34	0.11
Minimum Cool Time (yrs)	11.0	8.1	19.0	9.0	8.0
Maximum Active Fuel Length (in)	91	91	92	91	92

Notes:

<sup>(1)</sup> Combustion Engineering (CE) fuel with a maximum burnup of 32,000 Mwd/MTU, a minimum enrichment of 3.5 wt percent <sup>235</sup>U, a minimum cool time of 8.0 years, and a maximum decay heat per assembly of 0.304 kW is authorized.

<sup>(2)</sup> Exxon assemblies with stainless steel in-core hardware shall be cooled a minimum of 16.0 years with a maximum decay heat per assembly of 0.269 kW.

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5.(b)(1) Contents - Type and Form of Material (Continued)

(iii) Solid, irradiated, and contaminated hardware and solid, particulate debris (dross) or filter media placed in a GTCC waste container, provided the quantity of fissile material does not exceed a Type A quantity and does not exceed the mass limits of 10 CFR 71.53.

(iv) Irradiated intact Connecticut Yankee Class PWR fuel assemblies, RFAs, or DFCs within the TSC. The maximum initial fuel pin pressure is 475 psig. The fuel assemblies consist of uranium oxide pellets with the specifications, based on design nominal or operating history record values, listed below:

Assembly Manufacturer/Type	West. 15x15	B&W, & other (GA, NUMEC) 15x15	West. Vantage 5H	CY-MPC <sup>1</sup> RFA	CY-MPC <sup>2</sup> DFC
Cladding Material	SS	Zircaloy	Zircaloy	Zirc/SS	Zirc/SS
Maximum Number of Assemblies	26	26	24	4	4
Maximum Initial Uranium Content (kg/assembly)	433.7	395	390	212	432
Maximum Initial Enrichment (wt% <sup>235</sup> U)	4.03	3.93	4.61	4.61 <sup>3</sup>	4.61 <sup>3</sup>
Minimum Initial Enrichment (wt% <sup>235</sup> U)	★ 3.0	★ 2.95	★ 2.95	★ 4.2	★ 2.95
Maximum Assembly Weight (lbs)	1,350	1,230	1,230	1,500	1,500
Maximum Burnup (Mwd/MTU)	38,000	43,000	43,000	19,400	43,000
Maximum Decay Heat per Assembly (kW)	0.6538	0.6538	0.6538	0.321	0.6538
Minimum Cool Time (yrs)	10.0	10.0	10.0	10.0	10.0
Maximum Active Fuel Length (in)	121.8	121.1	120.6	121.8	121.8

Notes:

1. Reconfigured Fuel Assemblies (RFA) must be loaded in one of the 4 oversize fuel loading positions.
2. Damaged Fuel Cans (DFC) must be loaded in one of the 4 oversize fuel loading positions.
3. Enrichment of the fuel within each DFC or RFA is limited to that of the basked configuration in which it is loaded.

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5.(b)(1) Contents - Type and Form of Material (Continued)

(2) Maximum quantity of material per package

- (i) For the contents described in Item 5.(b)(1)(i): 26 PWR fuel assemblies with a maximum total weight of 39,650 lbs. and a maximum decay heat not to exceed 22.1 kW per package.
- (ii) For the contents described in Item 5.(b)(1)(ii): Up to 36 intact fuel assemblies to the maximum content weight limit of 30,600 lbs. with a maximum decay heat of 12.5 kW per package. Intact fuel assemblies shall not contain empty fuel rod positions and any missing rods shall be replaced by a solid Zircaloy or stainless steel rod that displaces an equal amount of water as the original fuel rod. Mixing of intact fuel assembly types is authorized.
- (iii) For intact fuel rods, damaged fuel rods and fuel debris of the type described in Item 5.(b)(1)(ii): up to 36 RFAs, each with a maximum equivalent of 64 full length Yankee Class fuel rods and within fuel tubes. Mixing of directly loaded intact assemblies and damaged fuel (within RFAs) is authorized. The total weight of damaged fuel within RFAs or mixed damaged RFA and intact assemblies shall not exceed 30,600 lbs. with a maximum decay heat of 12.5 kW per package.
- (iv) For the contents described in Item 5.(b)(1)(iii): for Connecticut Yankee GTCC waste up to 24 containers of GTCC waste. The total cobalt-60 activity shall not exceed 196,000 curies. The total weight of the waste containers shall not exceed 18,743 lbs. with a maximum decay heat of 5.0 kW. For all others, up to 24 containers of GTCC waste. The total cobalt-60 activity shall not exceed 125,000 curies. The total weight of the waste and containers shall not exceed 12,340 lbs. with a maximum decay heat of 2.9 kW.
- (v) For the contents described in Item 5.(b)(1)(iv): up to 26 Connecticut Yankee fuel assemblies, RFAs or damaged fuel in CY-MPC DFCs for stainless steel clad assemblies enriched up to 4.03 wt. percent and Zirc-clad assemblies enriched up to 3.93 wt. percent. Westinghouse Vantage 5H fuel and other Zirc-clad assemblies enriched up to 4.61 wt. percent must be installed in the 24-assembly basket, which may also hold other Connecticut Yankee fuel types. The construction of the two basket configurations is identical except that two fuel loading positions of the 26 assembly basket are blocked to form the 24 assembly basket. The total weight of damaged fuel within RFAs or mixed damaged RFAs and intact assemblies shall not exceed 35,100 lbs. with a maximum decay heat of 0.654 kW per assembly for a canister of 26 assemblies. A maximum decay heat of 0.321 kW per assembly for Connecticut Yankee RFAs and of 0.654 kW per canister for the Connecticut Yankee DFCs is authorized.

5.(c) Transport Index for Criticality Control

Minimum transport index to be shown on  
label for nuclear criticality control:

0.0

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6. Known or suspected damaged fuel assemblies or rods (fuel with cladding defects greater than pin holes and hairline cracks) are not authorized, except as described in Item 5.(b)(2)(iii).

7. For contents placed in a GTCC waste container and described in Item 5.(b)(1)(iii): and which contain organic substances which could radiolytically generate combustible gases, a determination must be made by tests and measurements or by analysis that the following criteria are met over a period of time that is twice the expected shipment time:

The hydrogen generated must be limited to a molar quantity that would be no more than 4% by volume (or equivalent limits for other inflammable gases) of the TSC gas void if present at STP (i.e., no more than 0.063 g-moles/ft<sup>3</sup> at 14.7 psia and 70°F). For determinations performed by analysis, the amount of hydrogen generated since the time that the TSC was sealed shall be considered.

8. For damaged fuel rods and fuel debris of the quantity described in Item 5.(b)(2)(iii) and 5.(b)(2)(v): if the total damaged fuel plutonium content of a package is greater than 20 Ci, all damaged fuel shall be enclosed in a TSC which has been leak tested at the time of closure. For the Yankee Class TSC the leak test shall have a test sensitivity of at least  $4.0 \times 10^{-8}$  cm<sup>3</sup>/sec (helium) and shown to have a leak rate no greater than  $8.0 \times 10^{-8}$  cm<sup>3</sup>/sec (helium). For the Connecticut Class TSC the leak test shall have a test sensitivity of at least  $1.0 \times 10^{-7}$  cm<sup>3</sup>/sec (helium) and shown to have a leak rate no greater than  $2.0 \times 10^{-7}$  cm<sup>3</sup>/sec (helium).

9. In addition to the requirements of Subpart G of 10 CFR Part 71:

- (a) The package must be prepared for shipment and operated in accordance with the Operating Procedures in Chapter 7 of the application, as supplemented.
- (b) Each packaging must be acceptance tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Chapter 8 of the application, as supplemented.

10. Prior to transport by rail, the Association of American Railroads must have evaluated and approved the railcar and the system used to support and secure the package during transport.

11. Prior to marine or barge transport, the National Cargo Bureau, Inc., must have evaluated and approved the system used to support and secure the package to the barge or vessel, and must have certified that package stowage is in accordance with the regulations of the Commandant, United States Coast Guard.

12. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.12.

13. Expiration date: March 31, 2004.

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NAC International, Inc., application dated December 30, 1996.

NAC International, Inc. supplements dated April 30, May 7, July 28 and 31, 1997; August 7, December 5, 12, 19, and 30, 1998; January 15, February 12, 23, and 27, March 1 and 22, 1999; October 5, June 7, August 1, and November 8, 2000; December 14 and 28, 2001, February 21, March 22, May 31, June 13, July 8, and August 23, 2002.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION  
**/RA/ original signed by C. Miller for /s/**  
E. William Brach, Director  
Spent Fuel Project Office  
Office of Nuclear Material Safety  
and Safeguards

Date September 27, 2002

