RELATED CORRESPONDENCE

May 9, 1985

DOCKETED
USNRC

'85 MAY 10 A10:10

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC
SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
VIRGINIA ELECTRIC AND POWER COMPANY	)	Docket Nos. 50-338/339-OLA-1
	)	
	)	
(North Anna Power Station, Units 1 and 2)	)	

TESTIMONY OF PAUL N. McCREERY

I.

Introduction

My name is Paul N. McCreery. I am Manager, Aiken Operations for Transnuclear, Inc. (TN). My address is 1607 Huntsman Road, Aiken, South Carolina 29801.

I received a B.S. degree in Physics from Louisiana State University in 1948. I have also had 30 hours of graduate studies in engineering and business. I have worked in the nuclear field in engineering and administrative capacities for 32 years, the last 13 of which were involved with spent fuel transport cask design, fabrication, licensing and operations. I have had extensive hands-on experience with every currently-licensed light water reactor spent fuel cask in the

8505130413 850509
PDR ADOCK 05000338
G PDR

U.S., plus other casks in the process of being licensed for transport or storage. This work is documented in reports on file in Allied-General Nuclear Services records and with the Department of Energy. My resume is attached to this testimony as Appendix 1.

I have been asked to address that portion of Concerned Citizens of Louisa County's (CCLC) Consolidated Contention 1 dealing with human error. That contention states as follows:

> The Staff's Environmental Assessment is inadequate and an Environmental Impact Statement should be prepared. . . . [T]he Environmental Assessment did not evaluate the probability and consequences of accidents occurring during the transportation of spent fuel casks from the Surry Station to the North Anna Station which might be occasioned by . . . error of applicant's employees in preparing the casks for shipment.

My testimony, in summary, is that design features and handling procedures associated with the cask that Virginia Electric and Power Company (Virginia Power) plans to use make insignificant the likelihood and effect of any human error in preparing casks for shipment.

II.

Cask description

A. General features

The particular TN cask to be used for the Surry-to-North Anna shipments is the model TN-8L. It is designed to carry three pressurized water reactor fuel assemblies, one in each of three compartments. Specifically, the cask cavity consists of three stainless steel square pressure vessels welded to an end plate and a circular stepped top flange, separated by a T-shaped copper plate and surrounded with boron carbide and copper plates. Each cavity is 230 X 230 mm and 4,280 mm long. The main shielding consists of 135 mm of lead, 26 mm of steel and 150 mm of resin. A wet cement layer is located between the lead and the outer steel shell to reduce heat flow in the event of fire. Radial copper fins are welded to the outer shell and cover the surface of the cask between the end drums.

Each end of the cask is surrounded by stainless steel drums reinforced by radial gusset plates and filled with balsa wood. A disk-shaped shock absorbing cover, constructed of carbon steel and balsa wood, is fastened to each drum with four, 1-1/4 inch bolts. The cask has six trunnions, which are the structures by which the cask is handled. Impact limiters are attached to the trunnions to reduce impact loads in the

event of a side drop onto a trunnion. Certain vent and drain lines, described below, which penetrate the inner cavity are equipped with positive closures. In addition, all access ports are protected by the shock absorbing covers. A copy of NRC's Certificate of Compliance, issued to certify that the cask meets the safety standards in 10 C.F.R. Part 71, is attached as Appendix 2. Also attached, as Appendix 3, is a diagram of the cask with its components labelled.

B. Penetrations

The principal cask penetration, of course, is the opening on the top of the cask through which spent fuel is loaded and unloaded. The lid that covers this opening is a welded stainless steel circular flanged shell containing lead and resin shields. The lid is secured by sixteen 1-1/4 inch diameter bolts and is provided with a double seal consisting of two concentric Viton "O-rings" located within recessed grooves on the top flange.

In addition, there are three penetrations that lead to the fuel cavity. The "A" penetration passes through the lid and is 1-1/2 inch in diameter. This penetration is used for cask evacuation and drying (in the vacuum drying test described below), and venting when the cask is being filled with water. The "A" penetration is sealed by the "A" plug, which is a lead-filled flanged cylinder that has one "O-ring" seal on the

underside of the flanged portion and is secured to the lid by three bolts.

The "B" penetration is a penetration from the bottom of the lid that passes upward through a Hansen valved quick-disconnect fitting. It is sealed by a circular flange with a single "O-ring" and is held in place by three bolts. The Hansen valved connector acts as a second seal. The "B" penetration is used to provide access for instrumentation to obtain pressure readings within the cask during cask handling operations. It is also used for backfilling the cask with nitrogen and, when the cask first arrives, to compare the pressures inside and outside the cask. If the cask pressure inside the cask is greater than that outside, the excess pressure is vented through the "B" penetration through the reactor's radwaste system.

The "C" penetration is a penetration formed by the drain lines at the bottom of the cask that converge into a single Hansen valved quick-disconnect fitting. It is used to drain water out of the cask and to fill the cask with water. It is sealed by a flange cover, with one "O-ring," and three bolts. Again, the Hansen valved connector acts as a second seal.

The "A" and "B" penetrations are located in the lid. The "C" penetration is located on the side of the cask near its bottom.

There is also an opening in the lid that does not lead into the fuel cavity. This "D" opening is an access port to the annulus between the two lid "O-rings". It is sealed by a threaded plug with an "O-ring" on the underside of the head of the plug. It allows access from the top of the lid to the space between the two "O-rings" so that the integrity of the main lid "O-rings" can be checked.

Each cover of the "A" through "D" openings has a Viton "O-ring", with a circular cross section. Three bolts in the "A", "B" and "C" penetrations, the threaded plug in the "D" opening, and the 16 bolts in the lid are torqued to levels specified in the operating procedures, in a specified sequence. The specified torque is applied to the bolts to compress the "O-rings" and form a tight seal against the metal on both sides, and to pre-stress the bolts. Metal to metal contact between the closure flanges in the lid or body limits the compression of the "O-rings" to pre-selected values to assure that no excessive force or deformation is applied to the Viton "O-rings" irrespective of the torque valves applied to the closure bolts. The Hansen valved connectors in the "B" and "C" penetrations act as a second seal.

III.

Safety-related design features

Certain design features of the model TN-8L cask minimize the potential for damage-producing human error in cask handling. Some of these design features make errors less likely. Some would minimize the effect of an error if one were committed. The cask is designed (1) to be shipped "dry;" (2) to carry fuel that is more recently discharged, and therefore hotter, than the Surry fuel; (3) to carry the maximum payload that can be transported by highway; (4) to have one more seal on the lid and on two of the other three penetrations into the cask cavity than is necessary to satisfy NRC requirements; (5) to use elastomeric sealing material rather than metallic seals; (6) to be of a relatively simple design; and (7) to withstand extreme accident conditions.

First, the cask is shipped "dry," i.e., with no water in the fuel cavities. That precludes the development of steam pressures inside the cask, since there is no residual water that can turn to steam. The absence of steam pressure reduces the possibility of a release of radioactive gas in the event an employee erred and, for example, failed to properly tighten the lid bolts, or failed to detect a defective seal. If no positive pressure exists inside the cask, there is no driving force to force radioactive gases outside the cask. Also, the less pressure, the less chance for a seal to fail.

Second, the casks were designed to carry fuel that has been discharged from the reactor only six months and is thus "hot" (thermally) with a decay heat of approximately eight kw per assembly. The design parameters of the cask enable it to contain pressures of 105 psig, with a safety factor of three. The Surry fuel that will be shipped to North Anna has been out of the reactors for over five years, with a heat output per assembly of less than two kw, and so is producing heat at only a fraction of the design capacity of the cask. This is another important safety factor over and above the original design safety factor of three. The fact that the fuel to be shipped is being selected from reactor discharges that indicated a low relative activity, and thus no major failures, also makes it less likely that a significant driving force would be created inside the cask.

Third, the cask is designed to carry the maximum payload that can be transported by highway. One unloading/loading cycle removes as much fuel as three loads in the only other available highway cask model. The likelihood of handling errors is thus decreased during any given shipping campaign, since Virginia Power will need one-third as many shipments with the model TN-8L cask.

Fourth, while only one seal for each penetration will satisfy NRC requirements, the cask features double seals for the lid opening and two of the other three penetrations into

the cask cavity. Thus, in the event a seal on the lid, or on the "B" or "C" penetration were defective, and an employee failed to detect this, another seal would back up the first seal. The "A" penetration has a single seal with a metal ("shield") plug.

Fifth, the cask uses seals made of a rubber-like material (Viton) rather than metallic seals. A seal containing this rubber-like material is less susceptible to damage than a metallic seal, in that if it is deformed during handling operations it will regain its original shape. This minimizes the possibility of additional handling which would be required if a seal had to be changed, and thus decreases the likelihood of error.

Sixth, the cask is relatively simple in design. The simplicity of design results in easy-to-follow operating procedures, which I shall discuss at greater length below. The less complicated the operation of the cask, the less likely it is for an error to occur. And, if an error occurred, it would be easily detected and corrected.

Finally, the cask is designed pursuant to 10 C.F.R. § 71.73 to withstand certain accidents without significant damage. For example, it is designed to withstand a 30 foot drop onto an essentially unyielding surface, a side drop of 40 inches onto a 6-inch diameter steel bar, exposure for not less than 30 minutes to a fire of not less than 1475°F. and

immersion under at least three feet of water for not less than eight hours.

Some of the benefits of the TN-8L can be illustrated by a few "what-if" questions. For example, what if one of the penetrations leading to the fuel cavity, once opened, is not subsequently sealed?

First, with the exception of the "A" penetration, not only one, but two, seals would have to be left open for there to be any passageway for radioactive gas to escape. Second, both the "B" and "C" penetrations contain Hansen valved connectors which have automatic closure devices that operate when a coupling is disconnected from them. Third, the absence of a proper seal would be indicated by both the leak test and the vacuum drying test, required by the operating procedure.

What if a seal is defective or the bolts are not tightened with enough force to properly compress a seal?

This is not likely to happen. Seals are visually inspected every time the cask is loaded or unloaded, and replaced if necessary. Indeed, examinations of the seals and bolt torquing are included in the quality control "checkpoints" that are required under the operating procedure. But even if a seal were defective, and this went undetected during inspection, no radioactive gas would escape. First, there is a second seal to back the first seal up on the lid and on the "B" and "C" penetrations. Second, since we are dealing with a dry

cask, the integrity of the lid seal and the "C" Hansen connector are verified during the dryness test. Further, if the bolts are not properly tightened or if the seal is defective on the lid, the "A" plug, the "B" flange, or the "C" Hansen connector, those penetrations will not pass the leak test. The operating procedure requires the operator to check whether the bolts are properly tightened if these tests are failed. If the bolts are properly tightened, the operator will disassemble and replace the seal and repeat the torquing and testing procedures. Cavity drying and leakage tests are performed under a vacuum. Dryness and leakage acceptance criteria would not be met with defective seals. Third, the cask is "backfilled" with nitrogen to one atmosphere (absolute), so that the pressures inside and outside the cask are equalized. In the absence of a driving force inside the cask to drive any gas past the seal, no gas will escape through a defective seal. Although residual heat from the spent fuel could increase the temperature and thus the pressure inside the cask, creating a driving force, any residual heat would be insignificant since the fuel to be shipped will be more than five years old. The driving force thus created would also be insignificant, and little, if any, gas would be driven past a defective seal.

What if fuel cladding fails when the shipment is en route?

The fuel rods are pressurized with gas. If the fuel cladding fails, gas will leak into the cask cavity and increase the cavity gas pressure. The cask is, however, designed to withstand far more pressure than would result even if all fuel rods in the shipment fail and all the pressurized gases are released into the cask cavity. The total accumulated gas in such a case will not create a pressure exceeding 20 lbs. per square inch, one-fifth the maximum working pressure the cask was designed to withstand. And since the cask has a design safety factor of three, the cask will actually withstand many times this amount of pressure. In any event, experience has shown that fuel that has not failed in the reactor is unlikely to fail in storage or during transport.

What if a seal began to leak en route?

Again, this is not likely to happen since (1) the seals are routinely replaced once a year despite the fact that the shelf-life of a seal is five years, and after the complete set is replaced, the cask is leak-tested under a vacuum of 1/1,000,000 of normal air pressure, (2) a deteriorating seal will fail the inspections and leak test, and (3) for a healthy seal to rupture in transit, more pressure would be required than can be generated in all combinations of pressure-increasing incidents that can take place within the cask under normal transport conditions. Seals are so well protected that it is difficult to develop a scenario for the failure of one en route.

In the unlikely event a seal did begin to leak en route, nowever, little gas would escape, since with fuel over five years old there would not be enough residual heat to create a significant driving force inside the cask. Even a modest amount of failed fuel will not drive gas out of the cask at a significant rate.

What if the tractor and trailer should separate from one another?

This happens occasionally in the trucking business and has been known to happen at least once with a spent fuel cask. There was no damage to either cask or trailer. The cask is designed to withstand far more severe accidents. Moreover, cask haulers have recently been required to formalize (QC check) the lock-up test procedure that is routinely performed by truck drivers.

What if the cask tie-downs were not secured?

Even if the cask is not tied down properly it will arrive at its destination without incident unless it is involved in a rather serious accident. If the cask should fall off the trailer en route, the probabability is very small that the cask would be seriously damaged. The cask is designed to withstand much more severe conditions without breach of containment.

The success of these design features has been borne out by experience. There are over 65 similar casks in use on a

routine basis throughout the world. They transport fuel that is much nearer the design limits for heat output and radiation than the Surry fuel. Other similar casks in the U.S. have transported over 30 loads of fuel from West Valley, New York to Morris, Illinois and are presently transporting fuel from West Valley to Forked River, New Jersey. To my knowledge, there have been no instances of human error of any consequence associated with any of these cask operations.

IV.

Cask Handling Procedures

From the time the empty cask is removed from the truck until it is placed back on the truck filled with spent fuel, the following procedures are prescribed:

1. The cask protective devices are removed.
2. Cask is taken to decontamination area.
3. Skirt (cover) is placed on it, so that radioactive contamination will not accumulate on fins while the cask is in the spent fuel pool.
4. The 16 bolts that engage the cask lid are removed.
5. Cask is filled with water then moved to the loading station in the pool.
6. Cask lid is removed while cask is under water.
7. Cask lid is lifted above the water with a crane.

8. The seals are inspected for defects.
9. Any seals that have defects are replaced.
10. Three assemblies are loaded into the cask.
11. The cask lid is replaced while cask is under water.
12. Cask is lifted partially out of water, and four bolts are replaced, hand-tight, in lid.
13. Cask is moved to decontamination area, and the remaining 12 bolts are installed.
14. Numbered template prescribing the order for bolt tightening is placed on the cask.
15. All 16 bolts are tightened to 290 ft. lbs. with calibrated torque wrenches.
16. The water in cask is drained (gravity draining) through penetration "C."
17. Leak tightness of the lid seal is checked through the "D" opening.
18. The air is evacuated from the cask.
19. Any remaining moisture is evaporated by the vacuum drying system.
20. When pressure inside cask is less than 20 millibars, cask is tested for 10 minutes. If pressure increases no more than three millibars during this time the seals are working and the cask is dry (vacuum drying test).

21. The evacuated cask is back-filled with nitrogen to prevent oxidation of the fuel.
22. The cask is backfilled with nitrogen to one atmosphere, in order to equalize the pressures inside and outside the cask.
23. Remaining penetrations into the cask are checked under vacuum for leak-tightness.
24. Skirt is removed, and the cask is ready to be moved to truck.
25. The cask is secured to its specially designed trailer by a system designed to restrain the cask in all three motion modes.
26. The cask protective devices are attached to ends and trunnions. Security seals are attached at each end.
27. These procedures are repeated when the shipment reaches its end destination and the cask is unloaded, except for the seal leak tests and except that four bolts remain in the lid until the loaded cask begins its descent into the fuel pool.

A supervisor watches as the operator performs each step of the operating procedure. The supervisor's responsibility is to ensure that the operators perform each step in the proper sequence and as prescribed by the operating procedure. The procedure contains a "check-off" space beside each step

delineated to verify that each step has been properly performed. In addition, whenever a step is taken that requires that its performance be verified by readings of pressure, torque or visual examination, these values or attributes are confirmed by a quality control representative.

These procedures, which will be introduced as Exhibits in this proceeding, are based on over 500 cask-years' operating experience. Similar casks have been used in Europe since the 1970's. There have been at least 50 loadings and unloadings in the United States. The procedures have evolved from this operating experience and from knowledge gained through technical investigations.

A generic operating procedure has been approved by NRC along with the cask's Safety Analysis Report. The site-specific procedures are reviewed and verified by Transnuclear, Inc. to conform to the generic requirements.

These procedures minimize the potential for human error. They are written so that the requirements of each step are clearly stated. They are detailed rather than complicated. They do not leave situations open to operators' interpretation. Again, each step must be checked-off by a supervisor, and every time observations affecting safety are made they are checked by a quality control inspector.

In addition, the procedures include "self-checking" operations, i.e., procedures that would make manifest any

earlier mistake. For example, the "dryness" test under vacuum will not pass if the lid or penetration bolts are not in place, or if the cask is not drained of water, or if the seals are defective.

I have observed in part at least eight loadings at West Valley and about as many unloadings at Dresden and Oyster Creek, all utilizing procedures similar to the Surry procedures. I have observed similar loadings and unloadings in Europe. I have the experience of participating in "dry runs" or training exercises in which the operators became familiar with casks before any fuel was handled. The only errors I ever observed took place during the earliest loadings, for which TN provided around-the-clock technical oversight, and these were inconsequential, for example, tightening lid bolts out of sequence or not turning on the vacuum pump for a proper warm up period before use.

Before the Surry-to-North Anna shipments are made, Virginia Power personnel will have been trained to properly implement these procedures. They have had about seven hours of class room instruction and one "dry run" without fuel, and will have TN technical oversight of initial operations.

V.

Conclusion

First, there are several cask design features that either decrease the likelihood of human error in preparing the cask for shipment or minimize the effect of an error if one were committed. In summary, (1) the cask is shipped dry, precluding the development of steam pressures inside the cask that could produce a driving force capable of propelling radioactive gas out of the cask; (2) the cask is designed to carry more recently discharged -- and therefore hotter -- fuel than Surry's, providing a safety factor over and above the original design safety factor of three; (3) the cask is designed to carry the maximum payload, enabling Virginia Power to reduce the number of shipments, and thus the amount of cask handling, required during a given shipping campaign; (4) the cask is designed so that the lid closure for the main cavity opening and two of the other three penetrations leading into the cask cavity have double seals, even though each individual seal adequately meets NRC requirements; (5) the cask is designed to use resilient rubber-like sealing material rather than metallic seals that are more easily damaged, eliminating the need for more handling during replacement; (6) the cask is simply designed, making it relatively easy to handle; and (7) the cask is designed to withstand extreme accident conditions.

Second, the cask handling procedures Virginia Power will implement make the likelihood of error in preparing the casks for shipment still more remote. These procedures are thorough rather than complex. They conservatively require checks and double checks. Thus, not only is a seal visually inspected, and then subjected to a leak test, it is also replaced annually, despite a five year shelf-life, whether or not it is deteriorated. It is then subjected to a still more demanding leak test. The drying test is also a verification of proper installation of the lid seals. For every step the operator performs, a supervisor must verify that it is done correctly. Required quality control checkpoints provide still another layer of assurance during the performance of the more important steps. These procedures were developed based on approximately 500 cask years' operating experience. The operating history of similarly designed casks attests to the cask design benefits and to the success of the operating procedures.

These design features and handling procedures make insignificant the likelihood and effect of any human error in preparing casks for shipment.

NAME: Paul N. McCreery

EDUCATION: BS, Physics; Louisiana State University, 1948
Graduate studies in engineering and business.

POSITION: Manager, Aiken Operations, Transnuclear, Inc.

EXPERIENCE:

9/83 to present, Transnuclear, Inc. Aiken, South Carolina

As Manager of Aiken Operations, he is responsible for field services of the Transnuclear, Inc. cask fleet. In this capacity he is responsible for the continuing recertification requirements (periodic testing, proper use in accordance with 10 CFR 71.87) of transport casks, spare parts control and delivery, maintenance of ancillary equipment, and development of special equipment. He is Project Manager for the conceptual design of a system of high capacity, new generation casks for a DOE-sponsored project. He participates in training programs for users of the Transnuclear, Inc. casks, and the oversight of loadings and unloadings as a follow-up to the training programs.

2/78 to 8/83, Allied-General Nuclear Services, Barnwell, SC

In the capacity of Project Engineer he worked extensively with every model of commercial LWR spent fuel shipping cask currently certified by USNRC, plus three other special purpose spent fuel casks and one cask which he designed and was built especially for studies in methods to improve cask handling techniques. Independent studies on cask fleet servicing were later extended under DOE contract to include more operations and advanced concepts. In each of these cask studies he made suggestions for improved handling techniques which were adopted by the casks' owners.

3/52 to 1/78, NL Industries.

3/52 to 2/70 Feed Materials Production Center, Fernald Ohio. At this facility he held positions in the nuclear materials accountability department from Technologist to Department Head. He also served as Department Head for Quality Assurance. Both departmental positions involved extensive work with procedure preparation, oversight and audits.

4/73 to 1/78 Barnwell Operations, Barnwell, SC.

As Manager, Cask Transportation Services he was responsible for the cask fleet (NLI 1/2's, NLI 10/24's, MTR and AECL). to serve exclusively the Barnwell reprocessing plant. During this time the casks were used, under his direction, to transport spent fuel and non-fuel-bearing components throughout the US and from Canada into the US.

3/72 to 4/73 Fabrication Center, Wilmington, DE.

As Manager of Administration he supervised Quality Assurance, Accounting, Procurement and Data Processing. He worked closely with fabrication operations (spent fuel casks for GE, Navy, GA, FFTF transfer cask, etc.). After later being transferred to Barnwell Operations, he was on two ocassions temporarily reassigned to this facility to troubleshoot operational problems.

2/70 to 3/72 Fuels Fabrication Plant, Albany, NY.

As Technical Services Manager he had direct responsibility for two QA organizations (fuel, non-fuel), accountability and data processing.

PUBLICATIONS RELATED TO SPENT FUEL CASKS

McCreery, P.N., et. al., "The Conceptual Design of a Spent Fuel Cask Fleet Servicing Facility", Allied-General Nuclear Services, AGNS-1040-1.5-48, September, 1978.

Anderson, R.T., McCreery, P.N., et.al.; "Simulated LWR Spent Fuel Receiving and Handling", Allied-General Nuclear Services, AGNS-1040-1.2-46.

McCreery, P.N. et. al.; "Operational Assessment of the NLI-1/2 Legal Weight Truck Spent Fuel Cask", Allied-General Nuclear Services, AGNS-1040-1.1-30, October, 1978.

McCreery, P.N., et. al., "Interface Criteria for Shipping Casks and Fuel Handling Facilities", Allied General Nuclear Services, Y/OWI/SUB-78/1, January, 1979.

McCreery, P.N., "Advanced Cask Handling Studies", Allied-General Nuclear Services, AGNS-35900-1.1-49, October, 1979.

McCreery, P.N. and Watson, C.D., "Fleet Servicing Facilities for Servicing, Maintaining and Testing Rail and Truck, Radioactive Waste Transport Systems", joint publication of Oak Ridge National Laboratory and Allied-General Nuclear Services, ORNL/Sub-79/13866/1 (AGNS-SFP-5), March, 1980. Presented as a paper at the Berlin, W. Germany, PATRAM conference Nov., 1980.

McCreery, P.N., "Cask Handling Equipment Standardization", Allied General Nuclear Services, AGNS-35900-1.1-106, October, 1980.

McCreery, P.N. "Operational Assessment of the Transnculear Transnuclear, Inc.-9 Truck Spent Fuel Shipping Cask", Allied-General Nuclear Services, AGNS-35900-1.1-157, November, 1981.

McCreery, P.N., et. al., "Operational Assessment of the FSV-1 (HTGR) Spent Fuel Shipping Cask in Alternate Modes", Allied-General Nuclear Services, AGNS-35900-1.1-157, November, 1981.

McCreery, P.N., et. al., "Spent Fuel Shipping and Cask Handling Studies in Wet and Dry Environments", Allied-General Nuclear Services, AGNS-35900-1.1-184, September, 1982.

Anderson, R.T., McCreery, P.N. and Maier, J.B., "An Evaluation of Nuclear Dual-Purpose Casks for Extended Storage and Shipping Usage in the Monitored Retrievable Storage Program", Allied-General Nuclear Services, Draft Report of Project 3123, October, 1982.

McCreery, P.N., "Development of Procedures for Cask Handling Demonstrations Using REA and GNS Spent Fuel Storage Casks", Allied-General Nuclear Services, PNL/3120-1.0, January, 1983.

McCreery, P.N., "Development of Procedures for Cask Handling Demonstrations Using REA and GNS Spent Fuel Storage Casks (Part 2)", Allied-General Nuclear Services, AGNS-11033-4.1-11, July, 1983.

RELATED INDUSTRIAL AND PROFESSIONAL ORGANIZATIONS

Member at Large, ANSI N-14 Transportation Committee

Chairman ANSI N14.27 "Guide for Carrier and Shipper Responsibilities and Emergency Response Procedures for Highway Transportation Accidents Involving Truckload Quantities of Radioactive Materials." 1985.

Member, ANS

Past Sr. Member, ASQC

Founding Member, INMM

/ct
0177C

NRC FORM 618
(6-83)
10 CFR 71

U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIALS PACKAGES

1.a CERTIFICATE NUMBER	b. REVISION NUMBER	c. PACKAGE IDENTIFICATION NUMBER	d. PA
9015	9	USA/9015/B( )F	Appendix 2

2. PREAMBLE

a. This certificate is issued to certify that the 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 of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions."

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

a. PREPARED BY (Name and Address):

Transnuclear, Inc.
One North Broadway
White Plains, NY 10601

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION:

Transnuclear, Inc. application dated April 9, 1980, as supplemented.

c. DOCKET NUMBER 71-9015

4. CONDITIONS

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

MAR 1 1 1985

5.

(a) Packaging

(1) Model Nos.: TN-8 and TN-8L

(2) Description

Lead, steel and resin shielded irradiated fuel shipping casks. The casks approximates a right circular cylinder 1,718 mm in diameter and 5,516 mm long. The cavity consists of three (3) stainless steel square pressure vessels welded to an end plate and a circular stepped top flange, separated by a T-shaped copper plate and surrounded with B4C + Cu plates. Each cavity is 230 x 230 mm and 4,280 mm long. The main shielding consists of 135 mm of lead, 26 mm of steel and 150 mm of resin. A wet cement layer is located between the lead and the outer shell. Radial copper fins are welded to the outer shell and cover the surface of the cask between each end drum. The Model No. TN-8 has 150 rows of fins and the Model No. TN-8L has 104 rows of fins.

The lid is a welded stainless steel shell containing lead and resin shields. The pressure vessels are closed and sealed by sixteen, 1-1/4-inch diameter bolts and two silicone rubber or Viton O-rings located within recessed grooves on the top flange. Each extremity of the cask is surrounded by circular stainless steel drums reinforced by radial gusset plates and filled with balsa wood. A disk shaped impact limiter, constructed of carbon steel and balsa wood is fastened to each drum with four, 1-1/4-inch bolts. The vent and drain lines which penetrate the inner cavity are equipped with positive closures. In addition, all access ports are protected by the impact limiters.

5. (a) Packaging (continued)

(2) Description (continued)

Trunnions are used for lifting and tie-down of the package. The casks weigh approximately 36,000 kg.

(3) Drawings

The Model No. TN-8 packaging is constructed in accordance with Transnuclear Drawing No. 9317.01, Rev. J. The Model No. TN-8L is constructed in accordance with Transnuclear Drawing No. 9317.138, Rev. A. The materials of construction and welds shall be in accordance with Annex A, B, and C to Chapter II of the Application.

(b) Contents

(1) Type and form of material

(i) Irradiated PWR uranium oxide fuel assemblies of the following specifications:

Fuel form	Clad UO_2 Pellets
Cladding material	Zr or SS
Maximum initial U content/assembly, kg	469
Maximum average initial U-235 enrichment, w/o	3.2
Maximum bundle cross section, in	8.5
Maximum active fuel length, in	144
Minimum cooling time, day	150
Maximum weight/fuel assembly, kg	733; and

Group I fuel assemblies

Initial fuel pin pressure at 100°F, psig	250
Maximum average burnup, MWD/MTU	38,500; or

Group II fuel assemblies

Maximum average burnup, MWD/MTU	36,000

(ii) Solid non-fissile irradiated hardware. As needed, appropriate component spacers must be used when loading irradiated hardware into the cask cavity to limit movement of the contents during accident conditions of transport.

5. (b) Contents (continued)

(2) Maximum quantity of material per package

(i) For the contents described in Item 5(b)(1), Group I fuel assemblies:

Three PWR assemblies. The maximum decay heat load is not to exceed 35.5 kilowatts per package and 12 kilowatts per assembly for the Model No. TN-8 packaging and 23.7 kilowatts per package and 7.9 kilowatts per assembly for the Model No. TN-8L packaging.

(ii) For the contents described in Item 5(b)(1), Group II fuel assemblies:

Three PWR assemblies. The maximum decay heat load and the maximum free gas volume are not to exceed the limits listed in the table below:

Decay Heat per Assembly, kw(a)	Maximum Free Gas per Assembly, m^3 (NTP)(b)
0.5	0.186
1.0	0.181
3.0	0.161
5.0	0.147
7.0	0.136
9.0	0.128

Notes: (a) Decay heat load per assembly must not exceed 7.9 kilowatts for TN-8L packaging.
(b) NTP conditions are 25°C and one (1) bar.

(iii) PWR assemblies may be shipped either with or without burnable poison rod, thimble plug, or control rod assemblies.

(iv) As needed, appropriate component spacers may be used in the cask cavity to properly position the fuel assemblies.

(v) The maximum weight of the contents (fuel assemblies, component spacers, inserts, irradiated hardware, etc.) must not exceed 2,200 kg.

(c) Fissile Class III

Maximum number of packages per shipment One (1)

6. The cask cavity must be dry (no free water) when delivered to a carrier for transport. For the contents described in Item 5(b)(1)(i), residual moisture must be promptly removed from the cask cavity by the methods described in Annex I to Chapter VIII of the Application and the cavity must be promptly backfilled with 1.0 atm of helium, nitrogen, or argon gas.

7. Known or suspected failed fuel assemblies (rods) and fuel with cladding defects greater than pin holes and hairline cracks are not authorized.

8. Prior to each shipment, the package must meet the tests and criteria specified for each shipment (operation) in Chapter VIII of the Application, as amended May 3, 1983 (Chapter 6.0, Operations Program).

9. The package contents must be so limited that under normal conditions of transport, the total dose rates must not exceed 17 mrem/hr at one meter from the surface of the package.

10. Any system used for cooling down the package must be provided with a pressure relief device set so that the maximum pressure in the containment vessel cannot exceed 7 atmospheres during the cool-down process.

11. The systems and components of each packaging must meet the periodic tests and criteria specified in Chapter VIII of the Application. Each packaging that fails to meet these criteria must be withdrawn from service until corrective action has been completed.

12. Repair and maintenance of the packaging must be as described in Chapter VIII of the Application.

13. All valves, fittings, seals and relief devices must be of the type, size, model and manufacture as indicated on the design drawings. The resin material must be of the specifications stated in Annex A to Chapter II of the Application.

14. Prior to first use, each packaging must meet the acceptance tests and criteria specified in Chapter VIII of the Application, as amended.

15. In accordance with Annex L to Chapter VIII, at periodic intervals not to exceed two years, the thermal performance of the cask must be analyzed to verify that the cask operation has not degraded below that which is licensed*. Following the initial acceptance tests, the heat source may be that provided by the decay heat from the loading of the package, provided that the heat source is equal to at least 25% of the design heat load for the package. Each cask that fails to meet the thermal acceptance criteria given in Annex L of the Application must be withdrawn from service until corrective action can be completed or the license amended to limit the package to a lower heat load.

    * The thermal performance test is not required at periodic intervals when the maximum decay heat load per package does not exceed 25% of the design heat load.

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

17. Expiration date: June 30, 1985.

REFERENCES

Transnuclear, Inc. application dated April 9, 1980.

Supplements dated: October 31, 1980; June 17, 1981; May 3, and 27, 1983; May 1, 1984; and February 25, 1985.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle and
Material Safety, NMSS

Dated: MAR 07 1986

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Transportation Certification Branch
Approval Record
Model Nos. TN-8 and TN-8L Packages
Docket No. 71-9015

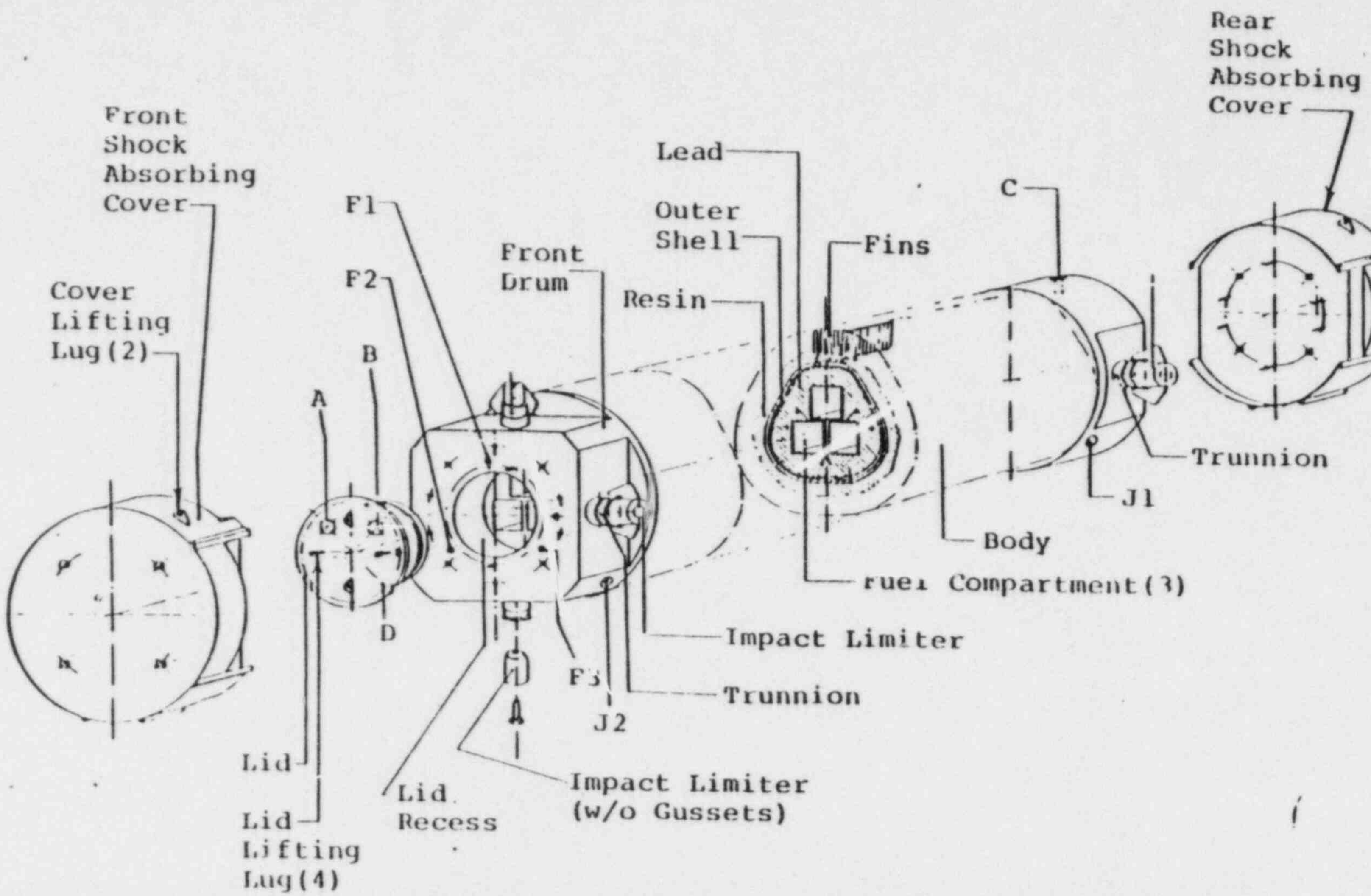
By application dated February 25, 1985, Transnuclear, Inc. requested a revision to Certificate of Compliance No. 9015 to permit the shipment of solid non-fissile, irradiated hardware.

The applicant would provide shoring, as needed, to limit movement of the contents during shipment (accident conditions of transport must be considered). The proposed contents would be within the presently authorized weight, thermal heat, and radiation limits.

The additional contents have no effect on the package's ability to meet the requirements of 10 CFR Part 71.

Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle
and Material Safety, NMSS

Date: MAR 0 7 1985



CASK OVERVIEW

Appendix 3