Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

June 15, 2017

10 CFR 71.95(c)

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Director, Division of Spent Fuel Management
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555-0001

Browns Ferry Nuclear Plant, Units 1, 2, and 3
Renewed Facility Operating License Nos. DPR-33, DPR-52, and DPR-68
NRC Docket Nos. 50-259, 50-260, 50-296

SUBJECT: **Report Pursuant to 10 CFR 71.95 (a)(3) and (b) - Failure to Follow Conditions of TN-RAM Packaging Certificate of Compliance No. 9233**

REFERENCE:

Certificate of Compliance No. 9233 for the TN-RAM Packaging, Revision 14

The Tennessee Valley Authority (TVA) is submitting this report pursuant to 10 CFR 71.95(a)(3) and (b) with respect to Certificate of Compliance (CoC) No. 9233, Revision 14, for the TN-RAM Packaging, Docket No. 71-9233. TVA is an authorized user of the TN-RAM packaging under the provisions of 10 CFR 71.17, *General License: NRC-approved package*.

Only one TN-RAM packaging has been fabricated and in use since 1989, prior to the discovery that the attachment points not intended for package lifting or tie-down were not rendered inoperable for transport operations as required by 10 CFR 71.87(h) and 49 CFR 173.41(b). The failure to render the impact limiter lifting lugs inoperable was noted during routine operations by a party other than TVA. Further review of the design determined that the attachment points intended for lifting the impact limiters will not withstand the static force required for lifting and tie-down in 10 CFR 71.45.

Immediate action was taken to install a cover on each impact limiter lifting lug retained by a bolt installed in the lifting lug through hole, which renders the attachment point inoperable. In addition to installing the cover, a durable marking, stating "IMPACT LIMITER LIFTING ONLY," was placed near each impact limiter lifting lug to identify the intended use of the lifting lugs.

A written report, as required by 10 CFR 71.95(c), is provided as Enclosure 1.

There are no new regulatory commitments associated with this submittal. If you should have any questions regarding this submittal, please contact Ed Schrull at (423) 751-3850.

Respectfully,

S. M. Bono
Site Vice President

Enclosure: 10 CFR 71.95 Report

cc (Enclosure):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Browns Ferry Nuclear Plant
NRC Senior Resident Inspector - Sequoyah Nuclear Plant
NRC Senior Resident Inspector - Watts Bar Nuclear Plant
NRC Project Manager for TN-RAM, SFM Licensing Branch

Enclosure

10 CFR 71.95 Written Report

Information required by 10 CFR 71.95(c) was prepared by TN Americas LLC and is included as an attachment to this enclosure. Additional licensee-specific information is provided below.

(2)(ii) Dates and approximate times of occurrences

The TN-RAM cask was used for shipments from the Browns Ferry Nuclear Plant (BFN) on the following dates:

10/11/2012

12/17/2012

1/14/2013

1/23/2013

2/4/2013

2/13/2013

2/18/2013

2/28/2013

3/11/2013

(6) Contact information

Please contact TVA Corporate Nuclear Licensing Manager Ed Schrull at (423) 751-3850 with any questions regarding this report.

Attachment (6 pages follow): 10 CFR 71.95 Written Report

10 CFR 71.95 Written Report

(1) Abstract

The TN-RAM package has trunnions intended as attachment points for lifting and tie-down. The trunnions are a structural part of the package that is designed to meet the requirements of the regulation for lifting and tie-down. Attachment points for lifting the impact limiters during installation and removal are a structural part of the impact limiters that are part of the TN-RAM package. An evaluation of the TN-RAM lifting attachment points demonstrates that the trunnions and impact limiter lifting lugs have been designed only for their intended use. Inadvertent use of the impact limiter lifting lugs to lift or tie-down the TN-RAM would impair the ability of the package to meet requirements for transport. However, operation of the TN-RAM has not included any controls to render the impact limiter lifting lugs inoperable during transport operations as required by transport regulations. An evaluation of the lifting and tie-down operations has been done to determine the extent of the condition and appropriate corrective actions to render the impact limiter lugs inoperable. A review of the NRC 10 CFR Part 71.78(h) regulatory requirements for Operating Controls and Procedures determined that use of the cask without rendering the impact limiter lugs inoperable is a practice that did not follow the conditions of the certificate of compliance.

(2) Description of the event

(i) Status of components or systems that were inoperable at the start of the event and that contributed to the event

The TN RAM cask system is a Type B transportation package design approved by the NRC (71-9233). The package is a steel encased lead shielded cask with wood impact limiters attached at both ends. The impact limiters are a packaging component that is required by the NRC approval of the package design. Impact limiters protect the cask shell and contents by absorbing shocks from impacts incidental to normal and accident transportation conditions. The cask shell is a right circular cylinder with trunnions welded to the outer shell for lifting and tie-down. The overall dimensions of the packaging are approximately 178 inches long and 92 inches diameter with the impact limiters installed. The cask body is approximately 129 inches long with an outer diameter of 51 inches. The maximum gross weight of the package is approximately 80,000 lbs. The structural evaluation for tie-down and lifting devices in the TN-RAM SAR states that there are no other structural parts of the package which can be used for tie down attachments.

(ii) Dates and approximate times of occurrences

The TN-RAM package first use was on or about 1989. The lifting lugs were not rendered inoperable during the period of operation since first use.

(iii) The cause of each component or system failure or personnel error

The TN-RAM SAR contains loading and handling guidelines that include general instructions for removal of the impact limiters using a "suitable crane and two legged sling", rotating and lifting the cask using a "suitable crane hook" to "engage the lift beam to the two front trunnions", and removal and installation of "front and rear trunnion tie-downs." The Operations and Maintenance Manual for the TN-RAM (OM-7) expands on the handling guideline and describes the trunnions intended purpose for lifting and tie-down of the cask. OM-7 also describes the impact limiter lifting lugs as "located such that the limiter is

balanced when it is lifted." The glossary of terms in OM-7 defines lifting lugs as "attachments provided on the impact limiters for handling operations," lift beams as "devices for cask lifting and handling operations," and trunnions as "handling attachments provided for cask primary lifting, support and tie-down." These definitions describe the intended purpose of attachment points. The design of the impact limiter rigging equipment is sized for attachment to the lifting lugs, and lift beams are specialized lifting devices that are designed for attachment to the trunnions. A dynamometer is installed between the crane hook and sling that is attached to the lifting lugs. The dynamometer is used to support the weight to allow removal of impact limiter bolts, and the procedure requires "lift up on the sling until a reading of 3700, +0, -100 pounds is indicated on the dynamometer." Any attempt to lift the weight of the TN-RAM package would exceed 3700 pound reading on the dynamometer. Tie-down members for the TN-RAM are trailer support pedestals specially designed for attachment to the trunnions.

The tarp installed over the support frame during transport has been considered a control to render the impact limiter lugs inoperable. The tarp when installed blocks access to the impact limiter lugs, but the lifting lugs are accessible when the tarp and support frame are removed for handling operations. Transport operations include the preparation of the package for transport (installing impact limiters), securing the package to the trailer for transit (tie-down), and receiving the package (removing impact limiters). During preparation for transport and receipt of the TN-RAM, the impact limiters are installed without the tarp in place. Prior to removal of the impact limiters and after installation the lift lugs are accessible.

Rigging equipment or tie-down members could inadvertently be attached to the lift lugs. However, lifting or tie-down of the TN-RAM using the lifting lugs would require intentional misuse of the rigging equipment and tie-down members, and violate operational controls and procedures for handling the cask. A method for rendering the lift lugs inoperable is required to prevent attachment to these points during preparation and receipt phases of transport operations. The tarp does not meet the intent of the requirement in the regulation to render the attachment point inoperable during all phases of transport operations.

(iv) The failure mode, mechanism, and effect of each failed component

The impact limiter attachment points are intended only for lifting the impact limiter during removal and installation while the TN-RAM package is attached to the transportation trailer. Each impact limiter weighs approximately 3700 lbs. The impact limiter shell is a structural part of the packaging that retains the wood shock absorber. The shell is sealed to protect the wood material from environmental conditions incident to routine use.

The impact limiter lifting lugs are designed for a safety factor against yield that is consistent with accepted industry standards for material handling using standard rigging equipment.

The nominal design weight of the impact limiter is 3695 lbs. The most likely failure mechanism or "weak link" in the attachment point on the impact limiter would be a tensile breakage of the lifting lug. Attempting to lift the package using the impact limiter lifting lugs would not result in damage to the structural impact limiter shell that would impair the ability to meet transport requirements.

The lifting lugs were not intended to tie-down of the TN-RAM during for transport. The stress applied to the lifting lugs used at attachment points for tie-down would be different than for the intended use to lift the impact limiters. A review of the impact limiter lifting design basis indicates that the lifting lugs would not withstand the stress applied by static forces required for tie-down in 71.45(a) or static force required by DOT for Protection Against Shifting and Falling Cargo (49 CFR 393).

(v) A list of systems or secondary functions that were also affected for failures of components with multiple functions

Lifting lugs are designed for the single purpose of lifting the impact limiter.

(vi) The method of discovery of each component or system failure or procedural error

Failure to render the impact limiter lugs inoperable was noted during routine operation of the TN-RAM.

(vii) For each human performance-related root cause, a discussion of the cause(s) and circumstances

Approved operational procedures and controls in place were followed since first use of the cask. There is no known instance of lifting or tie-down of the TN-RAM using the lifting lugs during nearly 30 years operating experience.

(viii) The manufacturer and model number (or other identification) of each component that failed during the event

No failure of the impact limiter lifting lugs occurred on the TN-RAM No. 001.

(ix) For events occurring during use of a packaging, the quantities and chemical and physical form(s) of the package contents

Quantities of radioactive material in form of activated metals shipped during use of the package varied during use. During this period of use the package contents was limited to about 14,000 Ci Co-60 equivalent activity that was recently increased in 2015 to a allow up to 30,000 Ci Co-60 equivalent activity.

(3) Safety Significance

The lifting lugs when used as intended have been evaluated to meet industry standards for rigging and material handling. Attempting to lift the TN-RAM using the lifting lugs would result in a yielding and tensile failure of the lifting lug. The structural shell of the impact limiter would not likely be damaged due to attempting to lift the package using the lifting lugs. Stresses generated in the impact limiter shell when used as a tie-down attachment point for securement of load during

transport have not been analyzed. Using the impact limiter lifting lugs as tie-down attachment points could generate stresses in the impact limiter shell that could result in tears or cracks. Undetected during the normal use or periodic inspections, these defects would allow moisture ingress and eventual degradation of the wood impact absorbing material that would impair the performance of the package during normal and accident transport conditions.

(4) Corrective Actions

Both engineering and administrative controls have been implemented to prevent inadvertent use of the impact limiter lugs for lifting or tie-down of the package. The engineering control is a cover for each impact limiter lifting lug that is retained by a bolt installed in the lifting lug through hole to render the attachment point inoperable. The lifting lug covers prevent attachment of rigging equipment or tie down members to the impact limiters lift lugs during transport (Figure 1).

Figure 1 – Lifting Lug Cover

An administrative control identifies the intended use of the impact limiter lifting lugs by a durable marking near each impact limiter lifting lug stating "IMPACT LIMITER LIFTING ONLY" (Figure 2). Additionally a statement should be added in the SAR Chapter 7- Operations and Operations and Maintenance Manual, OM-07 "TN RAM Operations Manual" subsection 8.5 that would require rendering the impact limiter lifting lugs inoperable and stating the allowed attachment points for lifting and tie-down of the TN-RAM. The SAR Chapter 7 is a condition of the § 71.17, General license: NRC-approved package, and OM-7 is provided to the cask users as a guide with more detailed instructions on implementing the operations requirements in the SAR.

Neither TN-RAM SAR Ch. 7—Operations or previous versions of Operations and Maintenance manual OM-7 include a requirement to render inoperable attachment points that are structural part of the package and not designed for intended package lifting or tie-down. The most recent version of OM-7 however, did add a requirement to render the lifting lugs inoperable by installing a bolt through the lug, or other similar method.

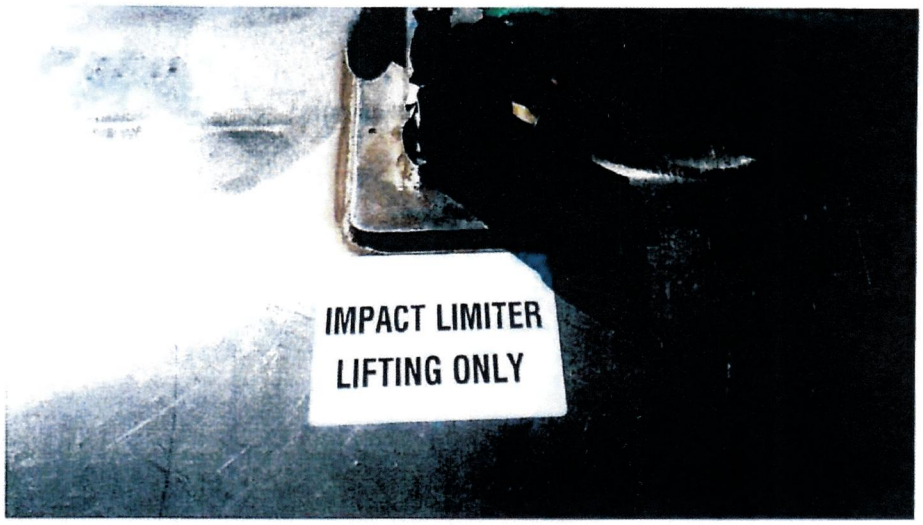

Figure 2 – Lifting Lug Marking

(5) Extent of the Condition

Operating procedures and design of the lift beam that are intended for lifting the cask and the lifting lugs make it improbable that the lift beam would be attached to the lifting lugs. Furthermore, the trailer trunnion pedestals are tie-down members specifically designed for attachment to the trunnions making it improbable that generic tie-down members attached to the lifting lugs would be used to secure the TN-RAM to the trailer.

The design and operation of the TN-RAM limits the possibility of inadvertent use of the impact limiter lifting lugs as package lifting or tie-down attachment points. All lifting and tie-down operations are controlled by detailed operating procedures and performed by trained and qualified personnel. The TN-RAM cask shell is lifted without the impact limiters installed. Impact limiters are removed from the cask shell prior to lifting operations to remove the cask shell from the trailer, and likewise the impact limiters are installed after lifting operations to place cask shell on the trailer is complete. Handling is done exclusively by persons trained in operation of the TN-RAM at the loading facility and unloading facilities, and transport is by exclusive use on a specialized trailer.

(6) Contact information

[The name and telephone number of a person within the licensee's organization who is knowledgeable about the event and can provide additional information]

(7) Extent of exposure of individuals to radiation or to radioactive materials

No individuals were exposed to radiation or to radioactive materials as a consequence of not rendering the impact limiter lifting lugs inoperable during transport operations.