August 17, 2007

Mr. B. K. Miles
Division of Naval Reactors
U.S. Department of Energy
Washington, DC 20858

SUBJECT: RE-ISSUANCE OF THE SAFETY EVALUATION REPORT FOR CERTIFICATE OF COMPLIANCE NO. 6003 FOR THE MODEL NO. M-130 PACKAGE

Dear Mr. Miles:

On July 16, 2007, the U.S. Nuclear Regulatory Commission issued the U.S. Department of Energy's Division of Naval Reactors a Safety Evaluation Report (SER) for the Model No. M-130 package. The SER is being re-issued to clarify an editorial discrepancy. The editorial change made to the SER is indicated by a vertical line in the margin. There are no changes to the staff's findings documented in the technical evaluation.

If you have any additional questions regarding this matter, we would be pleased to meet with you and your staff. You may contact me or Ms. Jessica Glenny of my staff at (301) 492-3285.

Sincerely,

/RA/

Robert A. Nelson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-6003

Enclosure: Safety Evaluation Report

Mr. B. K. Miles
Division of Naval Reactors
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SAFETY EVALUATION REPORT

Evaluation of Naval Reactors Request for One-Time Shipment of the Model No. M-130 Package Certificate of Compliance No. 6003 Docket No. 71-6003

SUMMARY

By application dated November 9, 2006, the U.S. Department of Energy's Division of Naval Reactors, requested an extension of the expiration date of Certificate of Compliance (CoC) No. 6003 for the Model No. M-130 package to perform a one-time shipment of NR-1 fuel modules. In its application, Naval Reactors explained that due to the current grandfathering provisions in 10 CFR 71.19, CoC No. 6003 for the M-130 package may only be renewed up to October 1, 2008. Naval Reactors requested the extension of the expiration date to allow shipment of the package beyond October 1, 2008.

Based on the statements and representations in the application, as supplemented, and the staff's review, the staff concludes that it cannot issue a CoC for the Model No. M-130 package with an expiration date after October 1, 2008 to support a one-time shipment of the package. However, the staff performed a technical evaluation of the proposed shipment and found that, subject to additional conditions, the one-time shipment can provide a level of safety equivalent to that provided by the regulations in 10 CFR Part 71.

The staff notes that this Safety Evaluation Report (SER) does not constitute, in any part, NRC approval of Naval Reactors request for a one-time shipment. The purpose of this SER is to document NRC staff's findings and their technical bases.

PACKAGE DESCRIPTION

The Model No. M-130 shipping container is an upright cylinder 84 inches in diameter by 158 inches overall height. The container walls consist of a finned 1-inch thick outer shell fabricated from either carbon steel, carbon steel with stainless steel clad, or solid stainless steel, 10 inches of lead shielding, and a 1-inch thick inner pressure vessel fabricated from carbon steel clad with stainless steel. The top of the container is covered with a shielded closure head which is bolted to the container and seals the pressure vessel. An access opening with a bolted shield plug is provided in the closure head for loading and unloading spent fuel.

The pressure vessel has an inside diameter of 55 inches. The central region contains a secondary heat exchanger (not used during shipment) surrounded by 1/2-inch thick carbon steel backup cylinder 29 inches in diameter. The annulus which remains between the backup cylinder and the pressure vessel provides a space 13-inches wide and 130-inches high for

spent fuel. The spent fuel is contained in the annulus by module holders designed for the particular core to be shipped.

The container has external penetrations to the pressure vessel for steam and water relief lines and a fill and drain line (which are capped during shipment) and a pressure sensing line which remains open to a pressure gage during shipment. The container also has penetrations which do not open to the pressure vessel for secondary heat exchanger lines (which are capped during shipment) and a temperature sensing line.

The container is supported on its transport vehicle by an "A" frame structure. The gross weight of the loaded container without its support structure is approximately 228,000 pounds.

BACKGROUND

Package History

The M-130 shipping container was initially certified for use by the Atomic Energy Commission (AEC) on May 15, 1969, in accordance with the requirements of AEC Chapter 0529. On February 2, 1973, the AEC issued the initial AEC Certificate of Compliance for the package. Based on this AEC certificate, NRC issued NRC CoC No. 6003, Rev. 0, for the M-130 package on June 13, 1978. The current revision of the certificate, Revision No. 20, will expire on September 30, 2007. The package identification number is USA/6003/B( )F.

Grandfathering Provisions

The latest revision of 10 CFR Part 71, which became effective on October 1, 2004 (69 FR 3698), incorporated, in part, the provisions in IAEA's Regulations for the Safe Transport of Radioactive Material, 1996 Edition (TS-R-1), related to the use of previously approved packages. These provisions, colloquially known as "grandfathering" provisions, allow packages approved under previous versions of the regulations to be used, provided they are properly maintained and no additional packages are fabricated.

The new grandfathering provisions of 10 CFR Part 71 specifically limit grandfathering of packages approved under the 1967 version of the IAEA regulations. NRC believes that packages approved under these standards lack the enhanced safety improvements that have been incorporated in packages approved under subsequent editions of the regulations. These improvements include a specified degree of leakage resistance and being subject to the quality assurance requirements of Subpart H of 10 CFR Part 71.

Nevertheless, in an effort to give users and certificate holders an opportunity to phase-out old packages and phase-in new ones, or demonstrate that these meet the current requirements, NRC implemented a 4-year phase-out period of 1967-approved packages that began on October 1, 2004, and will conclude on October 1, 2008.

Specifically, the provisions of 10 CFR 71.19(a) state that a package previously approved by NRC, and designated as Type B( ) or B( )F, may be used under the general license provisions of 10 CFR 71.17, provided it meets certain additional requirements, such as requiring that no new packagings be fabricated, and that any package modifications be limited in scope.

However, 10 CFR 71.19(a)(3) states that this provision will expire on October 1, 2008. Therefore, the use of Type B( ) and B( )F packages is not authorized after this date, and all Type B( ) and B( )F packages will be retired from use.

Request for Extension of Expiration Date of CoC No. 6003 for the Model No. M-130 Package

As a result of the grandfathering provisions of 10 CFR 71.19, the applicant, by letter dated November 9, 2006, requested that, in accordance with 10 CFR 71.41(d), a Special Package Authorization be approved by NRC to extend the expiration date of the M-130 package beyond October 1, 2008. The extension supports a final shipment of NR-1 fuel assemblies by DOE-Naval Reactors.

The provisions of 10 CFR 71.41(d) state that “packages for which compliance with the other provisions of these regulations [i.e., 10 CFR Part 71] is impracticable shall not be transported except under special package authorization.” The provision states that a special package authorization may be issued if the applicant demonstrates the following: (1) compliance with the other provisions of the regulations is impracticable, (2) requisite standards of safety established by the regulations are demonstrated through means alternate to the other provisions, and (3) the overall level of safety in transport for these shipments is at least equivalent to that which would be provided if all the applicable requirements had been met.

EVALUATION OF SPECIAL PACKAGE AUTHORIZATION REQUEST

Based on the information provided by the applicant and the staff’s evaluation of the applicable regulations, the staff concludes that it cannot issue a Special Package Authorization for a one time extension of the expiration date of CoC No. 6003 for the M-130 package. The staff has concluded that the provisions of 10 CFR 71.41(d) are only applicable to one-time shipments of large components that cannot be shipped inside a certified package, or for which designing a packaging would be impracticable. This conclusion is consistent with the statements of consideration for the proposed and final rule for the last revision of 10 CFR Part 71 (69 FR 3698 and 67 FR 21390). These state that the provisions of 10 CFR 71.41(d) will "apply only in limited circumstances and only to one-time shipments of large components." The intent of 10 CFR 71.41(d) was to fill a gap in NRC rules for very large components that "may contain significant quantities of radioactive material, but ... are so large that it may not be practical to fabricate authorized packagings for them (69 FR 3743)."

A Special Package Authorization for a one time extension of the expiration date of CoC No. 6003 for the M-130 package would not meet the criteria of a shipment of very large components that cannot be shipped inside a packaging, or for which it would be impracticable to design and fabricate an authorized packaging. The staff finds that the shipment would not need any special package design features or alternative methods for demonstrating compliance with the regulations that the provisions of 10 CFR 71.41(d) requires.

The provision of the regulations that the proposed one-time shipment would not meet are the grandfathering provisions of 10 CFR 71.19(a)(3). These provisions state that authorization for use of a Type B( )F package will expire on October 1, 2008. Use of the package beyond this date requires that the package meets the latest packaging standards of 10 CFR Part 71

(10 CFR 71.19(e)). Although the staff believes that, if performed prior to its expiration date, the proposed one-time shipment could be performed in compliance with the regulations and the conditions of the CoC, the staff cannot cite the provisions of 10 CFR 71.41(d) to approve an extension of the expiration date of CoC No. 6003 for the M-130 package. The fact that it may be costly to update the package design and modify the package to meet present regulations is not, by itself, sufficient for a finding that compliance with the regulations is impracticable, as required by 10 CFR 71.41(d).

SAFETY EVALUATION OF PROPOSED ONE-TIME SHIPMENT OF M-130 PACKAGE

Although the NRC cannot issue an approval for the one-time shipment under the provisions of 10 CFR 71.41(d), the staff has performed a technical evaluation of the proposed shipment to determine if the shipment could provide a level of safety equivalent to that provided if all the applicable regulations have been met.

To demonstrate that the one-time shipment could provide an equivalent level of safety, the staff's technical evaluation focused on making the following findings:

1. The applicant would ensure that the package continues to meet all the conditions of the last revision to CoC No. 6003 after its expiration, and until the one-time shipment is completed.

2. The applicant would evaluate the latest regulations in 10 CFR Part 71 and determine which new provisions the M-130 package design was not evaluated for when its initial CoC was issued. For those provisions that the package was not evaluated for, the certificate holder must show that the package already meets the specific provision or that it would implement special design features or operating controls during the shipment to compensate for not meeting these.

Evaluation of continued compliance with the conditions of the CoC

The issuance of a CoC for the M-130 package certifies that the package, when used and operated according to the conditions stated in the CoC, meets the applicable safety standards set forth in 10 CFR Part 71. Therefore, performing the proposed one-time shipment in compliance with these conditions ensures that it will continue to provide a level of safety equivalent to that provided if all the applicable regulations are met. Accordingly, the applicant must ensure that the one-time shipment is performed in accordance with all the conditions of the last revision of CoC No. 6003 for the M-130 package, regardless of its expiration date.

Although not included as a condition in the CoC, the staff notes that the applicant must perform the required maintenance and pre-shipment inspection procedures specified in the Safety Analysis Report for Packaging (SARP) for the M-130 package. The specific operating and maintenance and inspection procedures are discussed in Chapter 7 and 8 of the SARP, respectively. The applicant must continue to perform these procedures from the date of the package expiration until the completion of the one-time shipment. Continued performance of these procedures assures that the one-time shipment provides a level of safety equivalent to that provided for shipments made prior to October 1, 2008, and to shipments made in compliance with current regulations, as discussed below.

Evaluation of applicable regulatory standards

To demonstrate compliance with the current regulatory standards, the applicant performed an evaluation of the current regulatory requirements in 10 CFR Part 71 and its associated guidance documents, and compared it with the package's SARP to determine which provisions of the regulations the package design does not meet. The applicant's review and comparison of each technical discipline is discussed below:

Chapter 1.0: General Information

The applicant performed a review of the general information provided in Chapter 1 of the M-130 SARP and compared the analyses with those required under the current provisions of 10 CFR Part 71 and its corresponding guidance documents. The applicant has determined that the differences between current analysis standards and those in the M-130 SARP are editorial or administrative in nature. These differences do not introduce additional technical requirements nor do they affect the safety of the M-130 package design.

Chapter 2.0: Structural Evaluation

In its evaluation, the applicant identified several differences between the analyses in the M-130 package SARP and current provisions of 10 CFR Part 71 and its regulatory guidance. The only significant differences are discussed below:

2.1 Evaluation of Deep Water Immersion (external water pressure of 290 psig) for Type B packages containing more than 10^5 A_2.

The applicant states that the M-130 SARP does not contain an evaluation of package compliance with the requirements of 10 CFR 71.61, which states that packages containing more than 10^5 A_2 be designed so that its undamaged containment system can withstand an external water pressure of 2 MPa (290 psig) for a period not less than 1 hour without collapse, buckling, or inleakage of water. The provisions of 10 CFR 71.61 were not part of the regulations when the M-130 was initially certified.

The applicant provides an alternative method of compliance with these provisions by showing that, upon initial assembly after fabrication, the M-130 package is hydrostatically tested to an internal proof pressure of 525 psig without failure. The applicant states that although 10 CFR 71.61 requires an external pressure, the magnitude of the required external pressure is lower by a factor of three when compared to the critical buckling pressure of the M-130 package. The applicant states that this margin is conservative, since the critical buckling pressure is based only on the primary vessel wall thickness.

The staff has evaluated the assumptions made in the containment analysis and has determined that the applicant defines the boundary of its containment system as the fuel assemblies themselves. In the M-130 SARP, the applicant provides evidence that the fuel assemblies can withstand pressures higher than 2 MPa without any collapse, buckling, or inleakage of water. The staff has determined that although the M-130 SARP does not provide a demonstration of compliance with the requirements of 10 CFR 71.61, the design of the fuel assemblies provide alternate means of compliance with these provisions. The staff agrees that a one-time shipment of the M-130 package after its expiration date will provide an equivalent margin of safety.

2.2 Fracture Toughness Assessment for Container Closure Components up to 4 inches thick

The applicant states that the M-130 SARP does not contain an assessment of fracture toughness for closure components thicker than 4 inches, as recommended in Regulatory Guide 7.11. To demonstrate compliance with this guidance, the applicant shows that, in accordance with NUREG/CR-3854, Section 2.3, secondary closure components must be evaluated using Level of Safety Category III criteria. The fracture toughness requirements for Category III components (specified in NUREG/CR-1815) consist of ensuring that the material possesses "a fine grain practice" by manufacture, and that the material be normalized during the fabrication process. The applicant states that manufacturing certification records for the M-130 inner vessel shell materials show that Category III fracture toughness requirements are met.

The staff finds that this alternate demonstration of compliance is acceptable and ensures that an equivalent level of safety is maintained during the one-time shipment.

2.3 Fracture Toughness Assessment for Container Closure Component Welds

The applicant states that the M-130 SARP does not contain a fracture toughness assessment for the closure component welds. However, the applicant notes that the M-130 package is manufactured in accordance with ASME Code, Section VIII. Section VIII requires that the values of Charpy impact test results for welds be as high as those required for the base materials. The applicant states that the issuance of CoC No. 6003 for the M-130 package certifies that the package met all applicable requirements and the inclusion of an additional assessment for fracture toughness would not increase the level of safety of the M-130 package.

The staff agrees with the applicant and finds that the additional analyses would not significantly increase the level of safety of the M-130 package. The staff has determined that the current structural analyses of the M-130 package SARP are sufficient and ensure that an equivalent level of safety is maintained during the one-time shipment.

Chapter 3.0: Thermal Evaluation

The applicant's evaluation of the differences between the thermal analyses in the M-130 SARP and those required by current regulations shows that the analyses in the M-130 package SARP adequately show that it meets all applicable technical requirements, and any differences between these are editorial or administrative in nature. The staff concludes that the thermal analyses in the M-130 SARP ensure that an equivalent level of safety is maintained for a one-time shipment of the M-130 package after its expiration date.

Chapter 4: Containment Evaluation

The staff has evaluated the containment analyses in the M-130 SARP and compared them to the containment requirements specified in 10 CFR Part 71. The staff agrees that the releasable contents of the package are well below an A_2 value, and therefore, the package meets the containment requirements under hypothetical accident conditions as defined in 10 CFR 71.51(a)(2). Although the package was not originally reviewed against a quantified release limit under normal conditions of transport, the staff has reasonable assurance that the

performance of the package containment system, in conjunction with the compensatory measures to be taken during the one-time shipment, provides containment equivalent to that required by the current regulations.

Chapter 5: Shielding Evaluation

The applicant states that its evaluation of the shielding analyses in the M-130 SARP shows that the analyses meet the current requirements of 10 CFR Part 71. However, the applicant notes that their shielding analysis methods have been updated since the M-130 SARP was first issued. The applicant states that the original shielding analyses for shipment of NR-1 fuel assemblies in the M-130 package calculated the minimum time needed between shutdown of fuel assemblies and the start of the shipment (i.e., hold time) to be 50 days. The applicant has determined that new shielding analyses performed with more accurate computer codes show that the original analyses were less conservative, and a longer hold time is needed prior to shipment. Accordingly, the applicant has determined that the hold time should be increased to 90 days after shutdown.

The staff has evaluated the applicant's evaluation and has determined that the increased hold time for the M-130 package for shipment of NR-1 fuel assemblies is conservative and provides an additional level of safety. Accordingly, the staff has determined that the inclusion of a condition increasing the hold time of the M-130 package to 90 days is needed to ensure that a one-time shipment after its expiration date provides an equivalent level of safety.

Chapter 6: Criticality Evaluation

The applicant's evaluation of the differences between the criticality analyses in the M-130 SARP and those required by current regulations shows that the analyses in the M-130 package SARP adequately show that it meets all applicable technical requirements, and any differences between these are editorial or administrative in nature. The staff concludes that the criticality analyses in the M-130 SARP ensure that an equivalent level of safety is maintained for a one-time shipment of the M-130 package after its expiration date.

Chapter 7: Operating Procedures

The applicant's evaluation of the differences between the operating procedures in the M-130 SARP and those required by current regulations shows that the procedures in the M-130 package SARP adequately show that it meets all applicable technical requirements, and any differences between these are editorial or administrative in nature. Nevertheless, the applicant has requested that additional operational conditions and restrictions be incorporated for the proposed one-time shipment of the M-130 package. These conditions provide a compensatory increase in the safety of the package. These conditions are discussed in the "Conditions" section of the SER.

The staff concludes that the operating procedures in the M-130 SARP, subject to the additional conditions discussed in the "Conditions" section of this SER, ensure that an equivalent level of safety is maintained for a one-time shipment of the M-130 package after its expiration date.

Chapter 8: Acceptance Tests and Maintenance Program

The applicant's evaluation of the differences between the acceptance tests and maintenance program of the M-130 SARP and those required by current regulations shows that the requirements outlined in the M-130 package SARP are adequate and meet all applicable technical requirements, and any differences with regulatory requirements are editorial or administrative in nature. The staff concludes that the acceptance tests and maintenance program of the M-130 SARP ensure that an equivalent level of safety is maintained for a one-time shipment of the M-130 package after its expiration date.

Chapter 9: Quality Assurance Requirements

The staff has evaluated the quality assurance program description provided in Chapter 9 of the M-130 SARP and has determined that it meets the requirements of Subpart H of 10 CFR Part 71.

Conditions for one-time shipment of the Model No. M-130 Package

As discussed above, the staff has determined that a one-time shipment of the M-130 package after its expiration date would provide a level of safety equivalent to that provided if all applicable regulations are met, when subject to the following conditions:

1. The one-time shipment must be made in compliance with the conditions set forth in Certificate of Compliance No. 6003 for the M-130 package, unless amended by the conditions in this SER.

2. The one-time shipment must be performed in Container No. M-130-11.

3. The one-time shipment must have a heat load not to exceed 6,000 Btu/hr, and must be performed no earlier than 90 days after shutdown.

4. The applicant must continue to perform the package maintenance procedures outlined in Chapter 8 of the M-130 package SARP until the one-time shipment is completed.

5. Prior to the one-time shipment, the applicant must perform the package pre-shipment inspection procedures outlined Chapter 7 of the M-130 package SARP.

6. The maximum train speed during shipment must be 50 mph.

7. An exclusive-use conveyance must be used for the one-time shipment, which must be escorted and under constant 24-hour surveillance by Naval Nuclear Propulsion Program's escorts.

CONCLUSION

Based on the statements and representations provided by the applicant in the request dated November 9, 2006, a review of the package's SARP and referenced documents in CoC No. 6003 for the M-130 package, and for the reasons stated in this Safety Evaluation Report (SER), the staff has determined that, subject to the above stated conditions, the overall level of safety in transport provided by a one-time shipment of NR-1 fuel assemblies in the M-130 package would be at least equivalent to that which would be provided if all the applicable requirements of 10 CFR Part 71 had been met.

Issued on August 17, 2007.