

SAFETY EVALUATION REPORT

Docket No. 71-9337
Model No. 3979A
Certificate of Compliance No. 9337
Revision No. 2

SUMMARY

By letter dated April 20, 2015, as supplemented July 17, 2015, Croft Associates Ltd. submitted an amendment request to revise the certificate of compliance (CoC) for the Model No. 3979A package. The applicant proposed adding allowed contents to support a user need, allowing the use of an alternate stud lubricating material and other minor changes. NRC staff reviewed the application using the guidance in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material." Based on the statements and representations in the application, as supplemented, the staff agrees that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

1.0 GENERAL INFORMATION

1.1 Drawings

The applicant corrected an item number in a note on licensing drawing 0C-6042. The note incorrectly specified torque requirements for the cork liner instead of keg closure studs. As part of their initial request, the applicant also revised licensing drawing 0C-6042 to add the words "or equivalent" to allow the use of an alternate lubricating material because the lubricant listed on the licensing drawing was difficult to obtain. In response to a request for additional information (Agencywide Document Access Management System (ADAMS) accession number ML15198A079), the applicant revised licensing drawing 0C-6042 by listing Loctite 263, the manufacturer's suggested replacement material, on the licensing drawing instead of adding the words "or equivalent". In addition, the applicant added a view of the keg closure studs to clarify how the keg closure studs are manufactured. As a consequence of making these changes, the drawing list for the package, drawing 1C-6040, was also revised. Staff reviewed these changes and found them acceptable.

1.2 Packaging Contents

The applicant proposed adding Bismuth-210 (Bi-210) and Polonium-210 (Po-210) to the allowed contents of the package, and identified that these elements would be transported in the stainless steel insert, Design No. 3986. For both elements, the applicant defined in Table 1-4-3 the maximum quantity of radioactive material which could be loaded into the packaging. Since the Model No. 3979A is not authorized to transport liquids, and the applicant did not request authorization to ship liquid contents with this application, the contents are by default solids. Based upon a review of the information submitted, staff determined that the proposed contents have been adequately described.

1.3 Evaluation Findings

Based on a review of the statements and representations in the application, the staff concludes that the package has been adequately described to meet the requirements of 10 CFR Part 71.

2.0 MATERIALS

2.1 Evaluation

The applicant stated that Loctite 270, which locks and seals metal fasteners, is difficult to source and requested the use of an equivalent threadlocker. In response to an information request (ADAMS accession number ML15198A079), the applicant updated licensing drawings to show the use of Loctite 270 and Loctite 263 and the threadlocker importance to safety classification category. In section 2.2.2 of the SAR, the applicant discussed degradation due to chemical, galvanic or other reactions. The applicant stated that the package had been evaluated for all material interactions of chemically or galvanically dissimilar materials. The applicant also discussed acceptance tests and their maintenance program in section 8 of the SAR. The applicant showed that materials of construction are procured using consensus industry standards. In addition, Table 8-1 of the SAR summarized the maintenance requirements including periodic testing, inspection and replacement schedules.

The staff determined that Loctite 270 is a Green Threadlocker only available in Europe, and that the recommended replacement in the United States is Loctite 263 Red Threadlocker. Other than fixture time, Loctite 270 and Loctite 263 have the same strength and material composition. After reviewing the available literature/specifications, staff determined that Loctite 263 is an acceptable alternative to Loctite 270, and that Loctite 263 provides an equivalent assurance of safety. The staff concluded that, for the materials used to fabricate the package, there are few galvanic interactions and that the galvanic potential between these materials is low. Furthermore, visual inspections, which will be performed at various timed intervals, provide reasonable assurance that any significant corrosion will be discovered.

The staff finds that the Croft Safkeg-LS, Model No. 3979A, transportation package meets the regulatory requirements for mitigating galvanic or chemical reactions and is constructed with materials and processes in accordance with acceptable industry codes and standards.

2.2 Evaluation Findings

Based on review of the statements and representations in the application, the staff concludes that the materials design has been adequately described and evaluated and meets the requirements of 10 CFR Part 71.

3.0 SHIELDING EVALUATION

3.1 Evaluation

The review sought to verify that the Croft Safkeg-LS, Model No. 3979A, Type B(U) transportation package meets the external radiation requirements of 10 CFR Part 71 under normal conditions of transport (NCT) and hypothetical accident conditions (HAC) when adding Bi-210 and Po-210 as allowed contents for transport in the stainless steel insert. The staff evaluated the ability of the Safkeg shielding features to provide adequate protection from the radioactive Bi-210 and Po-210 contents. This review looked at the methods and calculations

employed by the applicant to determine expected dose rates at locations near the cask surface and at one meter from the cask surface.

The applicant's overall method was to back calculate the contents' acceptable activity limits from the regulatory dose rate, heat rate and mass limits. For final activity limits based on the dose rate regulatory limit, the applicant calculated radiation levels at the exterior of the as built Safkeg-LS 3979A package from gamma radiation using the MicroShield® code. Since the MicroShield® code cannot directly assess either beta or bremsstrahlung radiation, which is produced by the interaction of beta radiation with the shield material, and because both Bi-210 and Po-210 are pure beta emitters, the applicant used a conservative method to address the dose rates produced by these nuclides. The applicant's method was based on the Chapter 5 text of Cember's Introduction to Health Physics. Using equations from the text, the applicant estimated the photon bremsstrahlung radiation flux produced by the beta particles emitted by both Bi-210 and Po-210 and imported the gamma source into MicroShield® to predict the dose rate.

With regard to deriving content limits from the regulatory dose rate limits, the staff found this approach acceptable. However, in using this approach, uncertainties associated with the method must be addressed to assure that the dose rates from the proposed contents will not exceed the regulatory limits. Uncertainties in the method employed by the applicant include the use of International Commission on Radiological Protection Publication 51 (ICRP 51) flux-to-dose rate conversion factors associated with the MicroShield® code. The MicroShield® flux to dose rate conversion factors which produced the highest values were the ICRP-51 Anterior/Posterior dose conversion factors. However, the ICRP 51 dose conversion factors provide a lower surface dose rate than the staff approved conversion factors in American National Standards Institute/American Nuclear Society 6.6.1-1977. Therefore, the applicant applied a correction factor to the MicroShield® results as detailed in CTR 2015/10, "Uncertainties Associated with the Proposed Shielding Calculation Method for the SAFKEG-LS 3979A Package" (ADAMS accession number ML15198A085).

The applicant derived the maximum quantities of the allowable contents using the non-exclusive dose rate of 2 mSv/hr at the package surface. However, due to analytical uncertainties, the package fabrication tolerances employed in the shielding model and the surface dose rate calculation methodology, the calculated dose rates were increased in accordance with CTR 2015/10. Therefore, the calculated surface dose rates exceeded the non-exclusive use regulatory limits. Consequently, they were assessed against the exclusive use regulatory limits. Table 5-1 in the SAR shows the maximum NCT dose rates for the package including uncertainties. Staff found the dose rates reported by the applicant are below the regulatory limits. Staff also determined that the addition of Bi-210 and Po-210 as allowable contents will not cause the dose rate regulatory limits for HAC to be exceeded.

3.2 Evaluation Findings

Based on its review of the statements and representations in the application and independent confirmatory calculations, the staff finds reasonable assurance that the shielding design has been adequately described and evaluated and that the package meets the external radiation requirements of 10 CFR Part 71.

4.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM REVIEW

4.1 Evaluation

The applicant originally proposed to add language to step 4 of Section 8.2.3.2 to allow the use of a material “equivalent” to Loctite 270. In response to a request for additional information (ADAMS accession number ML15198A079), the applicant revised the proposed language to identify the manufacturer’s suggested replacement for Loctite 270. In addition, although Section 8.2.3.2 already allowed the replacement of keg closure studs, the applicant added a sentence to step 4, at the request of a package user, explicitly stating that keg closure studs can be replaced for clarity. Staff reviewed these changes and determined that they adequately define a replacement material for Loctite 270 and clearly identify that the keg closure studs can be replaced.

4.2 Evaluation Findings

Based on review of the statements and representations in the application, the staff concludes that the acceptance tests for the packaging meet the requirements of 10 CFR Part 71, and that the maintenance program is adequate to assure packaging performance during its service life.

CONDITIONS

The CoC includes the following condition(s) of approval:

Condition 5(a)(3) was revised to incorporate the most current revision to the drawings.

Condition 5(b)(2)(iii) was revised to incorporate new contents.

Minor editorial corrections were made.

CONCLUSIONS

Based on the statements and representations contained in the application, as supplemented, and the conditions listed above, the staff concludes that the design has been adequately described and evaluated, and the Model No. 3979A package meets the requirements of 10 CFR Part 71.

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