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| ONR Project Assessment Report  Mk A2 AGR Transport Flask (Design No. 2834) - Assessment of Modification N240 |



ONR Project Assessment Report

Project Name: Mk A2 AGR Transport Flask (Design No. 2834)

Report Title: Assessment of Modification N240

Dutyholder/Applicant: EDF Energy Nuclear Generation Limited

Authored by: K Hughes-Gill, Principal Inspector, ONR

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| Organisation | Recipient | Date Report Sent |
| ONR | G Frackelton, GB Transport Competent Authority  N Blackburn, Transport Permissioning Lead,  I Bramwell, Head of Operating Reactors, OFD  M Webb, Head of Assessment, OFD | 11/05/23 |
| Environment Agency | N/A | N/A |
| Dutyholder/ applicant | Stuart Austin, Flask Design Authority, EDF Energy | 11/05/23 |

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# Executive Summary

**Permission Requested**

EDF Energy Nuclear Generation Limited (the Applicant) has applied for a modification (N240) to the Mk A2 AGR Transport Flask (Design No. 2834) package design certificates for transport by road and rail within the United Kingdom for the refurbishment and entry into operational service of 15 Mk A2 fuel flasks.

**Background**

The A2 flask (variants A-E) is used to carry irradiated Advanced Gas-cooled Reactor (AGR) fuel between the Applicant’s AGR nuclear power stations and the Sellafield Nuclear Licensed site. The A2 flask is categorised as a Type B(M) package. 9.

The modification proposes to introduce 15 A2 flasks that have never been in operational service but have been placed in storage as strategic spares across the United Kingdom following manufacture in the 1990s. The objective of the modification is to detail the strategy for refurbishment of these flasks and techniques used to return them to design specification, as per the extant Package Design Safety Report, allowing them to be brought into service.

The Applicant has contracted the task of refurbishing the A2 flasks to two organisations (Altrad Babcock and Sellafield Ltd). ONR has undertaken a recent inspection of both organisations contracted to undertake the flask refurbishment as part of the renewal of the existing transport and shipment certificates for the GB/2834 package in 2022.

**Assessment and inspection work carried out by ONR in consideration of this request**

1. ONR carried out a programme of assessment of the Applicant’s claims, arguments, supporting documentation and evidence supporting modification number N240, to determine whether the proposed strategy complies with relevant transport legislation, and whether existing safety claims remain valid.

No significant safety matters of concern were identified from ONR’s assessment of the proposed modification.

The ONR shielding assessment supported approval of the proposed modification.

**Matters arising from ONR's work**

The ONR engineering assessment found that shortfalls identified during the renewal of the existing transport and shipment certificates for the GB/2834 package, specifically relating to Altrad Babcock’s ability to identify and record defects, and its ability to paint the flask to the requirements of the safety case documentation had not been resolved at the time of ONR’s assessment.

Defects in critical flask components or engineered tolerances have the potential result in safety consequences or incorrectly categorised modifications, and therefore it is important to gain regulatory confidence that these shortfalls have been resolved prior to introduction of the flasks into operational service. Therefore, the ONR engineering assessment does not support the release of the flasks being refurbished by Altrad Babcock into operational service. An ONR Inspection is planned to identify whether these shortfalls have been resolved.

**Conclusions**

I conclude that the proposed strategy for refurbishment of the flasks by Sellafield Ltd is sufficient to ensure compliance with the current package design and shipment certificates.

At present, the Applicant has been unable to demonstrate that it is able to meet the expectations of its management system, or the requirements of the existing safety case, in relation to the flasks being refurbished by Altrad Babcock. Therefore, I conclude that a further inspection of Altrad Babcock is required to ensure the Applicant is compliant with the current package design and shipment certificates.

**Recommendation**

It is recommended that the GB/2834 package design modification sheet for modification N240 is endorsed, with the caveat that this endorsement is for the flasks being refurbished by Sellafield Ltd only (Flask numbers E123, E128, E130, E134).

1. Altrad Babcock will be subject to further ONR inspection in May/June 2023, and dependent upon the satisfactory outcome of this inspection, the Applicant can apply for release of the remaining flasks via submission of an appropriately categorised modification.

# List of Abbreviations

AGR Advanced Gas-cooled Reactor

CA Competent Authority

GB Great Britain

HOW2 ONR’s Management System Platform

IAEA International Atomic Energy Agency

NGL Nuclear Generation Limited

ONR Office for Nuclear Regulation

PDSR Package Design Safety Report

RI Regulatory Issue

UK United Kingdom

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# Permission Requested

1. EDF Energy Nuclear Generation Limited (the Applicant) has applied for a modification to the Mk A2 AGR Transport Flask (Design No. 2834) package design certificates for transport by road and rail within the United Kingdom for the refurbishment and entry into operational service of 15 Mk A2 fuel flasks [1].

# Background

## Legislation

1. This Report presents the basis of the regulatory decision by the Office for Nuclear Regulation (ONR) as Great Britain (GB) Competent Authority (CA) for the transport of Class 7 (radioactive material) dangerous goods, to grant a modification to the current Design and Shipment Approvals for the Type B(M) Mk A2 AGR Transport Flask (Design No. 2834) variants A, B, D and E [1].
2. This statutory duty is given to ONR through The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG) [3].
3. The following modal regulations apply to allow transport by road and rail:

* European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2023 Edition [4];
* Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) 2023 Edition [5].

1. The above modal regulations are based on the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, currently SSR-6 [6] supported by advisory material in SSG-26 [7]
2. The A2 flask (variants A-E) is used to carry irradiated Advanced Gas-cooled Reactor (AGR) fuel between the Applicant’s AGR nuclear power stations and the Sellafield Nuclear Licensed site.

## Purpose of Modification

1. Modification N240 [1] is requesting permission to refurbish 15 Mk A2 AGR Transport Flask (Design No. GB/2834), also known as the A2 Flask, which were manufactured in the early 1990’s. These 15 packages have not seen operational service since manufacture, and have been stored as “strategic spares”. There are currently 31 GB/2834 packages in use regularly in the UK.
2. Defueling of the AGR stations has resulted in the need for additional flasks, and therefore demand for the strategic spares to enter operational service. This requires them to be refurbished to ensure they are compliant with the existing design approved by the GB Competent Authority (CA) in the extant design approval certificates [2].
3. Modification N240 [1] details the proposed strategy which will be adopted by the Applicant, rather than detailing the specific repairs undertaken on each A2 Flask. The Applicant has stated that each flask will be individually inspected, and the appropriate refurbishment will be undertaken at this stage, depending on the severity of any degradation.
4. The modification [1] limits refurbishment to the use of existing maintenance procedures and repair techniques covered by the existing safety case [8] and used within the existing fleet during routine maintenance. If a new/novel repair technique is required to return a flask to compliance, then this will require submission of an appropriately categorised modification, likely to be a Category A or B.
5. Within the modification [1], the Applicant has detailed examples of what it considers Category C modifications, which mainly includes minor dimensional non-conformances, and material loss marginally outwith the values permitted by the safety case [8].

## Overview of package design

1. The Mk A2 AGR flask has been designed for the transport of AGR fuel elements and components. The package design comprises a forged carbon steel flask body with attached external cooling fins, a flask lid assembly and an internal stainless-steel skip (of 2 different designs) carrying the radioactive contents.

## Flask History

1. The existing operational fleet of Mk A2 AGR fuel flasks entered service from 1991 onwards. Although a total of 47 flasks were manufactured, fitted out, inspected and prepared for duty, only 31 flasks entered operational service. This was approved by the Department for Transport as the GB CA at that time.
2. The remaining 16 flasks were placed into strategic storage, distributed between Scottish Energy (now EDF Energy), Nuclear Electric (now EDF Energy) and Magnox (now NDA) [9]:
   * 1. Torness - 3 flasks, serial numbers E113, E114, E115;
     2. Hunterston B - 1 flask, serial number E112;
     3. Heysham (EDF-owned) - 8 flasks, serial numbers E99, E116, E117, E118, E120, E121, E122, E137; and
     4. Heysham (NDA-owned) - 4 flasks, serial numbers E123, E128, E130, E134.
3. Flask E118 was removed from storage at Heysham some years ago and used for destructive testing. It is not suitable for refurbishment and is outwith the scope of Modification N240 [1].

## Refurbishment Strategy

1. The storage of the flasks has been in the open and in a coastal environment that has led to external surface paint loss and corrosion, including material loss from the flask body and cooling fins. The Applicant has proposed that inspection, examination and refurbishment of the flask (including internals) will be undertaken by:
   1. Sellafield Limited (for the 4 NDA-owned flasks); and
   2. Altrad Babcock (for the remaining 11 EDF-owned flasks).
2. The modification [1] proposes that the flasks will be returned to the design specification as per the flask safety case, through demonstrating compliance with the flask engineering drawings, including any existing modifications/concessions. This will entail full refurbishment and the replacement of all consumable spares, using existing maintenance procedures and repair techniques which are documented within the safety case and existing modifications/concessions, and have been previously approved by the GB CA where necessary.
3. The flask serial numbers covered by the existing safety case [8] are notified to ONR as the GB CA. All refurbished flasks being brought into service will be supported by a refurbishment quality pack produced by the Applicant that provides evidence of inspection, repair and refurbishment work completed to demonstrate compliance with the existing safety case [8]. This will be added to the original manufacturing and acceptance data and the flask case histories to provide a detailed record in each case.

## Further modification strategy post approval of modification N240

1. Following approval of modification N240 [1], the Applicant intends to produce further modifications for each flask, detailing the refurbishment undertaken, which will be appropriately categorised in accordance with ONR’s Guidance for applications for GB Competent Authority approval [10] and the Applicant’s own arrangements.
2. If new/novel repairs are required for any specific flasks, this will entail further modification proposal(s). Category C modifications will be self-approved by the Applicant and submitted to ONR for information. Any Category A or B modifications will be subject to CA approval prior to releasing the flask into operational service.

# Assessment and Inspection Work Carried out by ONR in Consideration of this Request

1. In accordance with the regulatory permissioning plan ONR has carried out a shielding assessment [13] and an engineering assessment [14]. These assessments were carried out as desktop assessments. No inspection activities were undertaken as ONR undertook inspection activities in 2022 [11] as part of the request by the Applicant for renewal of the design and shipment certificates.
2. Assessment was undertaken in accordance with the requirements of the Office for Nuclear Regulation (ONR) How2 Business Management System (BMS) and its associated guidance.
3. ONR has recorded regulatory queries via a Q1 query log [12] to record queries and applicant’s responses associated with N240. All regulatory questions have been satisfactorily addressed by the Applicant, with ONR Assessment Inspectors signing off their respective section in the log.

## Shielding Assessment

1. The shielding assessment [13] considered the impact of material loss due to corrosion on the shielding performance of the flask, and its ability to ensure that radiation dose rates external to the package satisfy the requirements of the IAEA Transport Regulations, SSR-6 [6], as implemented in UK law.
2. The shielding assessment [13] also considered the neutron shielding provided by the borosilicone layer. The shielding assessor considered the borosilicone layer to be a key design feature in meeting the requirements of SSR-6 [6], however no inspection is undertaken by the Applicant during refurbishment activities.
3. The Applicant has demonstrated that the flask build records confirm the original insertion of borosilicone as per the design specification and flask safety case. The Applicant claimed that there is no operational experience of borosilicone degradation. This has been confirmed via routine radiation dose rate measurements on flask dispatch.
4. The shielding assessor was content that the Applicant had presented a reasoned argument providing assurance that the borosilicone neutron shielding would not be compromised as part of the refurbishment activities and was content to support permissioning of modification N240.

## Engineering Assessment

1. The ONR assessment [14] sampled the package integrity, thermal insulation and package containment. The assessment did not identify any significant shortfalls with Modification N240. However, it did highlight that outstanding shortfalls associated with defect identification and categorisation by Altrad-Babcock had yet to be satifactorily addressed. This is discussed further in Section 4 of this report.

## Safety Case Requirements Assessment

1. The purpose of a Safety Case Requirements assessment is to address the non-engineering means of achieving compliance with the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, currently SSR-6 (2012 edition) [6], supported by advisory material in SSG-26 (2012 edition) [7], such as in the use, operation, and maintenance of the approved package design. It also complements the engineering assessment of the package design by reviewing the manufacturing processes to ascertain that the manufactured package conforms to the design intent.
2. A Safety Case Requirements (SCR) assessment was previously undertaken as part of the approval for the renewal of the existing transport and shipment certificates for the GB/2834 package in 2022 [12]. This was also a Category A modification (Modification N0219). Given how recent this assessment was undertaken, and no changes were proposed to the existing safety case or management system as a result of this modification, it was not considered necessary to undertake a further assessment as part of this assessment. However, a review of existing Regulatory Issues was undertaken.
3. There is one Regulatory Issue (RI-11022) still open from the renewal of the shipment and design certificates for the Mk A2 transport flask which specifically relates to the package maintenance. I am content that the consequences of this open issue is adequately addressed within the Engineering assessment [14]. and the subsequent matter arising

# Matters Arising from ONRs Work

1. The matters arising from the work carried out by ONR specialists are summarised as follows:
2. Although the engineering assessment did not identify any significant shortfalls with Modification N240, it did highlight that outstanding shortfalls associated with defect identification and categorisation by Altrad-Babcock, (previously identified during the renewal [16] of the Mk A2 transport flask design and shipment certificates), could result in nuclear safety consequences.
3. At the time of the renewal of the A2 flask design and shipment certificates, the shortfalls were deemed to be minor as minimal refurbishment work had been undertaken. An inspection was planned to provide confidence in Altrad-Babcock’s ability to record and resolve defects adequately prior to the approval of modification N240. However, due to delays with refurbishment at Altrad-Babcock, this inspection is now planned for May/June 2023.
4. To release the flasks into operational service, it is important that they comply with the drawing and other associated documentation, or that defects are recorded and approved via an appropriately categorised modification. Incorrectly recorded defects on critical areas of the flask could result in significant safety consequences, or the incorrect categorisation of a modification
5. The engineering assessment therefore recommended approval of Modification N240 [1] only for the flasks being refurbished by Sellafield Ltd.
6. I support this recommendation, and recommend endorsing the modification sheet, with the caveat that approval only extends to the flasks being refurbished by Sellafield Ltd. Altrad Babcock will be subject to further ONR inspection in May/June 2023, and dependent upon the satisfactory outcome of this inspection, the Applicant can apply for release of the remaining flasks via submission of an appropriately categorised modification.

# Conclusions

1. I conclude that the proposed strategy for refurbishment of the flasks by Sellafield Ltd is sufficient to ensure compliance with the current package design and shipment certificates.
2. At present, the Applicant has been unable to demonstrate that it is able to meet the expectations of its management system, or the requirements of the existing safety case [8], in relation to the flasks being refurbished by Altrad Babcock. Therefore, I conclude that a further inspection of Altrad Babcock is required to ensure the Applicant is compliant with the current package design and shipment certificates.

# Recommendations

1. It is recommended that the GB/2834 package design modification sheet for modification N240 [1] is endorsed; with the caveat that this endorsement is for the flasks being refurbished by Sellafield Ltd only (Flask numbers E123, E128, E130, E134).
2. Altrad Babcock will be subject to further ONR inspection in May/June 2023, and dependent upon the satisfactory outcome of this inspection, the Applicant can apply for release of the remaining flasks via submission of the appropriately categorised modification.

# References

1. EDF Energy Nuclear Generation Limited (NGL) - MODIFICATION NUMBER N240, E/REP/BRDB/0007/AGR/03 - WIReD Ref: ONRW-2019363590-880
2. Existing package design and shipment certificates:
   1. GB/2834A/B(M)F Rev. 12 (expiry date of end of 30 September 2027)
   2. GB/2834B/B(M)F Rev. 12 (expiry date of end of 30 September 2027)
   3. GB/2834D/B(M) Rev. 12 (expiry date of end of 30 September 2027)
   4. GB/2834E/B(M) Rev. 4 (expiry date of end of 30 September 2027)
   5. GB/2834A/B(M)FT Rev. 15 (expiry date of end of 30 September 2027)
   6. GB/2834B/B(M)FT Rev. 13 (expiry date of end of 30 September 2027)
   7. GB/2834D/B(M)T Rev. 16 (expiry date of end of 30 September 2027)
   8. GB/2834E/B(M)T Rev. 4 (expiry date of end of 30 September 2027)
3. The Carriage of Dangerous Goods and use of Transportable Pressure Equipment (2009) Regulations
4. European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), 2023
5. Regulations concerning the International Carriage of Dangerous Goods by Rail (RID), 2023
6. IAEA Regulations for the Safe Transport of Radioactive Material, Specific Safety Requirements Number SSR-6, 2018
7. IAEA, SSG-26, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, 2012 Edition
8. EDF Energy Nuclear Generation Limited (NGL) - Package Design Safety Report (PDSR) - E/REP/BRDB/0007/AGR/03 - WiRED Ref: ONRW-2019369590-996
9. EDF Energy Nuclear Generation Limited (NGL), Further Flasks in Readiness – Outset Spares Strategy EAN, LT/EAN/DGSF/009/AGR/18 WiRED Ref: ONRW-2019369590-968
10. TRA-PER-GD-014 - Guidance for applications for UK Competent Authority approval
11. ONR-OFD-IR-22-014, Doosan Babcock, Compliance inspection of refurbishment arrangements for the Mk A2 AGR Transport Flask (Design No. 2834) package, K Hughes-Gill, 2022/55500
12. GB/2384/B(M)F Mod N240 - Q1AR Assessment Review Form, January 2023, CM9 Ref: 2023/6208
13. ONR Technical Assessment File Note - Radiation Protection – Shielding Assessment, R Bowden, CM9 Reference: 2023/10880
14. ONR-TD-AR-22-003 - Safety Case Requirements Assessment – K Hughes-Gill CM9 Ref: 2022/31401
15. AR-01115 - Mk A2 Irradiated Fuel Transport Flask – Engineering Assessment of Modification N240 – K Hughes-Gill and T McLoughlin, WIReD Reference: ONRW- 2126615823-450
16. ONR-TD-PAR-22-002, Competent Authority Certificate Renewal for package GB/2834 (Modification number N0219), K Hughes-Gill, CM9 Reference: 2022/39499