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| ONR Project Assessment Report  GB Approval of CASTOR® HAW28 Transport Package |



ONR Project Assessment Report

**Project Name**: ONR Transport Package Approval

**Report Title**: GB Approval of CASTOR® HAW28 Transport Package

**Dutyholder/ Applicant**: Gesellschaft für Nuklear-Service

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# Executive Summary

Gesellschaft für Nuklear-Service (GNS) have applied to the Office for Nuclear Regulation (ONR) for the validation of transport package design certificate D/4325/B(U)F, trademarked as the CASTOR® HAW28M. The package has been approved multiple times by ONR; the most recent validation being in February 2020. This report presents the basis of the regulatory decision by the ONR as Great Britain (GB) Transport Competent Authority (TCA) for the transport of Class 7 (radioactive material) dangerous goods. The statutory duty is given to ONR through The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG).

The package is a 116.5 tonne, cylindrical, dual-purpose transport and storage cask used to transport up to 28 cannisters of fissile vitrified waste arising from reprocessing of German spent nuclear fuel at Sellafield Ltd. In 2020, ONR produced a GB design certificate validating the package with contents restricted to fissile vitrified waste arising from Sellafield Ltd reprocessing operations.

ONR has undertaken a programme of work to assess the Safety Assessment Report (SAR), its claims, arguments, supporting documentation and evidence, considering the criticality, engineering, radiation shielding and safety case requirements (SCR) aspects of the safety submission in respect of compliance with the relevant transport regulations. The changes to the SAR since the 2020 ONR approval are minor and as such, proportionate assessments were undertaken, focusing on any changes since the last review. The ONR engineering assessment targeted the changes to manufacturing arrangements. The impact of design changes to the radiation shielding and criticality safety reports were negligible and the ONR assessments undertaken to support the approval reflected this. The SCR assessment focused on Human Factors, targeting in particular the operational and managerial requirements necessary to ensure safe implementation of the design (and whether the requirements can be readily implemented) and the operating and maintenance instructions used to support the safe and reliable use of the package. Regulatory queries were raised with the Applicant through the assessment process and the Applicant responses were adequate.

ONR assessments of all four specialist areas recommended approval of the package design. Based on the work carried out by ONR, and the confidence in the foreign approval of the CASTOR® HAW28 package, I am satisfied that the package design satisfies the requirements of the relevant transport regulations.

I recommend that the ONR TCA should validate the transport package design CASTOR® HAW28 by revising the GB partial validation certificate, restricted to Sellafield Ltd content, to GB/5125/B(U)F (Rev.1) to run concurrently with the German certificate D/4325/B(U)F (Rev. 4).

Five further recommendations were made during the ONR assessments requiring future action to be taken by the Applicant. These will be tracked via an ONR regulatory issue.

Table 2: List of abbreviations

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| Term/Acronym | Description |
| CA | Competent Authority |
| CDG | The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations |
| GB | Great Britain |
| ONR | Office for Nuclear Regulation |
| SAR | Safety Assessment Report |
| SCR | Safety Case Requirements (Assessment) |
| TCA | Transport Competent Authority |
| UK | United Kingdom |

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# Permission Requested

1. Gesellschaft für Nuklear-Service (GNS) have [applied](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/Application%20letter%20-%20V137-011-sh.pdf?csf=1&web=1&e=yJyPxN) [1] to the Office for Nuclear Regulation (ONR) for validation of transport package design CASTOR® HAW28M. The package has been approved by the German Competent Authority (CA) and certified as [D/4325/B(U)F-96](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/German%20Validation%20Certificate%20(English%20Translation)%20-%20D_4325_B(U)F-96%20E,%20Rev.%204.pdf?csf=1&web=1&e=58LaoQ) (Rev. 4).
2. This report presents the basis of the regulatory decision by the ONR as Great Britain (GB) CA for the transport of Class 7 (radioactive material) dangerous goods. The statutory duty is given to ONR through The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG) [2].

# Background

1. The package is used to transport vitrified waste to mainland Europe. Only material arising from reprocessing operations at Sellafield Ltd is required to be transported in GB under this validation, and as such, a GB package design certificate will be issued with the contents restricted to Sellafield Ltd vitrified waste.

## The Package

1. The D/4325/B(U)F package design is trademarked as the CASTOR® HAW28M. The package is a 116.5 tonne, 7 metre long, 2.75 metre diameter, cylindrical, dual purpose transport and storage cask. Protruding from the thick-walled cylindrical cask body (spheroidal graphite ductile cast iron and neutron shielding) are radial fins, which enhance heat transfer to the environment.
2. The cask closure system consists of a primary lid, closure lid (both stainless steel) and the respective appropriate boltings and seals. It is equipped with lid end, bottom end and side wall shock absorbers.
3. Within the cask, a copper basket can accommodate up to 28 canisters of fissile vitrified waste, with a total thermal power output of up to 45 kW arising from reprocessing of German spent nuclear fuel at Sellafield Ltd.

## Related Approvals

1. The package is currently [licensed](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/German%20Validation%20Certificate%20-%20D_4325_B(U)F-96,%20Rev.%204.pdf?csf=1&web=1&e=SmDktK) [3] as a type B(U)F package in Germany until February 2028. The current German approval has been fully [validated](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/French%20Validation%20Certificate%20-%20F_667_B(U)F-96%20(d).pdf?csf=1&web=1&e=RG6Gqe) [4] by the French Competent Authority.
2. The D/4325/B(U)F was last [validated](https://prodonrgov.sharepoint.com/:w:/r/can_permissioning/PR-01053/GB5125%20(D4325)%20Validation%20CoA%202020.DOCX?d=wd91017b12020436eb3029f74ed2a55ed&csf=1&web=1&e=NMnNAI) [5] (restricted to Sellafield Ltd vitrified waste) by ONR in 2020 and the certificate is due to expire in July 2023.

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

1. A regulatory permissioning plan was devised and agreed with the Transport Competent Authority (TCA) permissioning lead. In accordance with this plan and ONR transport guidance [6], a targeted and proportionate assessment of the safety case was undertaken, taking into account previous ONR approvals and the German CA approval.
2. The D/4235/B(U)F design is underpinned by a [safety assessment report](https://prodonrgov.sharepoint.com/can_permissioning/Forms/GDAs.aspx?FolderCTID=0x0120003BC50A0F7FA7F74DBFD9895CD3139263&id=%2Fcan%5Fpermissioning%2FPR%2D01053%2FSAR&viewid=c028b57a%2D5c88%2D4784%2D8935%2D5940980ed6ef) (SAR), outlined in an overarching [structure document](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/Structure%20and%20documents%20of%20the%20SAR%20-%20V137-013-sh.pdf?csf=1&web=1&e=DkOaIe) [7] translated into English and subdivided into three parts:

* Part 1 (Design) provides administrative information and the detailed technical analyses. The content of Part I is listed in Report No. [GNB B 061/2007 E Rev. 15](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/SAR/Part%20I/UVZ-Teil%20I_GNB%20B%20061_2007%20E%20Rev.%2015.pdf?csf=1&web=1&e=WMEDVl).
* Part 2 (Construction) provides the specification of the packaging and includes the manufacturing drawings and parts list as well as material specifications. The content of Part II is listed in Report No. [GNB B 055/2003 E Rev. 18](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/SAR/Part%20II/UVZ-Teil%20II_GNB_B_055_2003%20E%20Rev.18.pdf?csf=1&web=1&e=rgRGRX).
* Part 3 (Operation / Maintenance) provides the requirements for Operation and Maintenance. The content of Part III is listed in Report No. [GNB B 230/2006 E Rev. 17](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/SAR/Part%20III/UVZ-Teil%20III_GNB%20B%20230_2006%20E%20Rev.%2017.pdf?csf=1&web=1&e=9hioR5).

1. All ONR assessments took cognisance of the following; certificates have been issued by two reputable foreign CA’s; there is confidence in the Applicant’s process for producing transport safety cases and they have a good track record; the CASTOR® HAW28M is not a novel or complex design; the package has been approved multiple times by ONR; and the changes to the package design are minor and have been detailed in a [periodic design review](https://prodonrgov.sharepoint.com/:b:/r/can_permissioning/PR-01053/Periodic%20Design%20Review%20and%20Route%20Map%20-%20GNS%20T%2001003_2022,%20Rev.%200.pdf?csf=1&web=1&e=tH0akS).

## [Criticality Assessment [8]](https://prodonrgov.sharepoint.com/:w:/r/_layouts/15/Doc.aspx?sourcedoc=%7B365CDE8B-C826-4260-B8A0-B38FB37AA164%7D&file=GB5125%20(TCA000060)%20-%20Technical%20Note%20-%20Criticality%20Assessment%20of%20CASTOR%20HAW28M%20D4325.docx&action=view&mobileredirect=true&cid=c280a78e-3237-4f65-a464-9d0375abe1fa)

1. The criticality safety aspects of the D/4325/B(U)F package design were only recently assessed by ONR in 2020. As the validation was required for transport in GB, the 2020 criticality assessment was restricted to consideration of material generated at Sellafield Ltd. Since 2020, there have been no modifications to the design of the package that require consideration from a criticality perspective.
2. The scope of this assessment was therefore restricted to a review of; the updated criticality safety documentation from the applicant; any outstanding criticality safety issues since the last GB validation; any changes introduced through the subsequent revisions of SSR-6 [9] and the advisory material in SSG-26 [10] that are relevant to this application.
3. There are two key criticality safety documents included in the SAR, and although both have been updated for this application, the only changes noted are the up-issue of supporting references. There is no significant change relevant to criticality since the last ONR validation in 2020.
4. The ONR criticality assessment considered the effects of temperature changes to the reactivity of the system. One regulatory question was raised with the Applicant who provided additional analysis that supports the claim that temperature effects will not challenge the criticality safety criterion.
5. The ONR criticality assessor judged that changes in regulations since the previous approval are not relevant to the criticality safety case.
6. The ONR criticality assessor concluded that the applicant has adequately demonstrated criticality safety of the package and that it meets the requirements of the relevant criticality transport regulations.
7. Two recommendations were made:
   * + 1. From a criticality perspective, the ONR TCA should validate the German certificate of approval D/4325/B(U)F with the radioactive content restricted to material generated by reprocessing operations at Sellafield Ltd.
       2. The applicant, before any future renewals with ONR, should update/append the SAR to include specific analysis regarding the macroscopic and microscopic effects of temperature within the IAEA range on the reactivity of the system.

## [Engineering Assessment](https://wired.crm11.dynamics.com/main.aspx?appid=58b7bb57-c806-ec11-b6e5-00224841dad4&pagetype=entityrecord&etn=can_assessment&id=8a1aa391-cc5a-4d0e-92ac-5d244a73d887) [11]

1. The ONR engineering aspects of the D/4325/B(U)F package design were recently assessed by ONR in 2020. A major assessment report was produced. There have not been any significant modifications to the design of the package since the previous assessment.
2. The scope of this assessment was therefore restricted to a review of; ageing management and design changes; manufacturing (although this was assessed in the previous ONR assessment, manufacturing arrangements have changed); and non-conformances.
3. The ONR engineering assessor reviewed; the periodic design review; the SAR; documents supplied to ONR during the assessment process (including an assessment report of the manufacturer and acceptance certificates for the packages proposed to be used in the UK). Furthermore, discussions were held between ONR and the German Competent authority regarding their inspections and oversight of the revised manufacturing process. No regulatory questions were raised during the assessment.
4. The ONR engineering assessor concluded that the applicant has adequately demonstrated safety of the package and that it meets the requirements of the relevant transport regulations from a mechanical engineering perspective.
5. One recommendation was made:

From a mechanical engineering perspective, the ONR TCA should validate the German certificate of approval D/4325/B(U)F.

## [Radiation Shielding Assessment](https://wired.crm11.dynamics.com/main.aspx?appid=58b7bb57-c806-ec11-b6e5-00224841dad4&pagetype=entityrecord&etn=can_assessment&id=1112197e-9f87-4c5a-a88b-bd7f446f8d58) [12]

1. The ONR radiation shielding aspects of the D/4325/B(U)F package design were recently assessed by ONR in 2020. There have not been any significant modifications to the design of the package that could impact the previous ONR judgement.
2. The scope of this assessment was restricted to a review of the relevant radiation shielding safety justification, and in particular, considering potential changes since the last ONR approval that could impact the radiation shielding safety case (including incorporation of historic non-conformances).
3. The ONR radiation shielding assessor confirmed that changes to the documentation were in alignment with the periodic design review and would not impact the radiation shielding safety case. No regulatory questions were raised with the Applicant.
4. The ONR radiation shielding assessor concluded that the Applicant has adequately demonstrated safety of the package and that it meets the requirements of the relevant transport regulations from a radiation shielding perspective.
5. Two recommendations were made:

From a radiation shielding perspective, the ONR TCA should validate the German certificate of approval D/4325/B(U)F.

The applicant, before any future renewals with ONR, should update/append the SAR (and in particular, the radiation shielding assessment) to include the analysis of the impact of basket torsion/rotation and modification to the recess of the primary lid on external dose rates.

## [Safety Case Requirements (SCR) Assessment](https://prodonrgov.sharepoint.com/:w:/r/can_permissioning/PR-01053/SCR%20Assessment.docx?d=wd236a580dc75480eadc6474f16af7631&csf=1&web=1&e=GS9MZw) [13]

1. An ONR SCR assessment addresses the non-engineering means of achieving compliance with the requirements of SSR-6, such as in the use, operation and maintenance of the approved package design.
2. A GNS SCR assessment was undertaken during the 2020 CASTOR® HAW28 approval. The judgements remain valid for this approval; the previous SCR assessment recommended approval and there have been no significant changes to the package design, or operational experience, that challenge the judgements made by ONR in 2020.
3. A detailed [Human Factors](https://prodonrgov.sharepoint.com/:w:/r/can_assessment/AR-01193_Internal_Only/GB5125%20-%20Human%20Factors%20Assessment%20AcpR.docx?d=wccbb61c527b24bd1a7a873b0ab78623f&csf=1&web=1&e=15UBOi) assessment [14] was undertaken to support the current SCR assessment. The Human Factors assessment focused on whether GNS suitably and sufficiently identified the operational and managerial requirements necessary to ensure safe implementation of the design (and whether the requirements can be readily implemented) and the operating and maintenance instructions used to support the safe and reliable use of the package.
4. The Human Factors assessment found that the SAR identified operational limits to support safe implementation of the design for the tasks sampled, and that the operational limits for containment closure and leak testing were adequately captured in the operating and maintenance instructions.
5. The Human Factors assessment identified shortfalls against good practice in the identification of the safety function and safety significance of the operational limits; in the analysis to confirm that they are reliably achievable; and in the provision of information in the package instructions. The ONR assessor judged that the safety impact of these shortfalls were small based on the fact that; Sellafield Ltd is the only user of the package in Great Britain as defined by the Competent Authority’s Certificate of Approval for the package; only defined content held by Sellafield Ltd can be loaded into the packaging; GNS and Sellafield Ltd have collaborated significantly to develop Sellafield Ltd’s arrangements; Sellafield Ltd has conducted cold trials to test implementation of the arrangements (with GNS in attendance); Sellafield Ltd has successful consigned ten packages internationally; and Sellafield Ltd’s instructions resolve the shortfalls identified above.
6. Three regulatory questions were raised with the Applicant. Detailed responses with supporting arguments and evidence were provided.
7. The ONR SCR assessor, with the support of the Human Factors assessment, concluded that the applicant has adequately demonstrated safety of the package and that it meets the requirements of the relevant transport regulations with respect to implementation of the safety case (specifically, the SCR requirements).
8. Four recommendations were made:
9. From a safety case implementation perspective, the ONR TCA should validate the German certificate of approval D/4325/B(U)F.
10. Prior to the next renewal of the GB/5125, or change of allowable content, or change / addition of user, GNS should:
11. ensure that the safety significance of the operational limits is clearly and explicitly identified, and should clearly and explicitly identify the safety function these limits support;
12. ensure that the package instructions accurately, completely, and concisely provide any operational limits or administrative controls, without the need for the user to refer to the wider package documentation or third-party documents;
13. review the suite of operating and maintenance instructions against relevant good practice to ensure all necessary information on the safe use of the package such as, but not limited to, the explicit identification of the safety significant steps, and the provision of information (such as warnings and cautions) is included and appropriately presented to support safe and reliable operation.

# Matters Arising from ONRs Work

1. None.

# Conclusions

1. Based on the work carried out by ONR, and the confidence in the foreign approval of the CASTOR® HAW28 package, I am satisfied that the package design meets the requirements of the relevant transport regulations.

# Recommendations

1. I recommend that the ONR TCA should validate the transport package design CASTOR® HAW28 by revising the GB partial validation certificate [5] (restricted to Sellafield Ltd content) to GB/5125/B(U)F (Rev.1), to run concurrently with the German design certificate D/4325/B(U)F (Rev. 4) [3].
2. There are five further recommendations made; these will be communicated to the Applicant and tracked via regulatory issue [RI-11575](https://wired.crm11.dynamics.com/main.aspx?appid=58b7bb57-c806-ec11-b6e5-00224841dad4&pagetype=entityrecord&etn=can_regulatoryissue&id=3ba6c601-f14d-42b5-8281-f34671c3d85b):
3. GNS, before any future renewals with ONR, should update/append the SAR to include specific analysis regarding the macroscopic and microscopic effects of temperature within the IAEA range on the k-eff of the system.
4. GNS, before any future renewals with ONR, should update/append the SAR (and in particular, the radiation shielding assessment) to include the analysis of the impact of basket torsion/rotation and modification to the recess of the primary lid on external dose rates.
5. Prior to the next renewal of the GB/5125, or change of allowable content, or change / addition of user, GNS should ensure that the safety significance of the operational limits is clearly and explicitly identified, and should clearly and explicitly identify the safety function these limits support
6. Prior to the next renewal of the GB/5125, or change of allowable content, or change / addition of user, GNS should ensure that the package instructions accurately, completely, and concisely provide any operational limits or administrative controls, without the need for the user to refer to the wider package documentation or third-party documents.
7. Prior to the next renewal of the GB/5125, or change of allowable content, or change / addition of user, GNS should review the suite of operating and maintenance instructions against relevant good practice to ensure all necessary information on the safe use of the package such as, but not limited to, the explicit identification of the safety significant steps, and the provision of information (such as warnings and cautions) is included and appropriately presented to support safe and reliable operation.

# References

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| [2] | The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG) 2009. (SI 2009 No. 1348). |
| [3] | ONRW-2019369590-1147, German Validation Certificate - D\_4325\_B(U)F-96, Rev. 4. |
| [4] | ONRW-2019369590-1146, French Validation Certificate - F\_667\_B(U)F-96 (d). |
| [5] | ONRW-2019369590-3281, GB5125 (D4325) Validation CoA 2020. |
| [6] | ONR Guide TRA-PER-GD-001 Revision 3 “ONR Transport Permissioning Process Guide” CM9: 2021/14609. |
| [7] | ONRW-2019369590-115, Structure and documents of the SAR - V137-013-sh. |
| [8] | GB/5125/B(U)F D/4325/B(U)F – CASTOR® HAW28M – TCA000060. |
| [9] | IAEA Safety Standards: SSR 6, ‘Regulations for the Safe Transport of Radioactive Material (2018 Edition)’ www.iaea.org. |
| [10] | IAEA Safety Standards: SSG 26, ‘Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2018 Edition)’ www.iaea.org. |
| [11] | ONRW-2126615823-987, AR-01178 - CASTOR - Mechanical Engineering Assessment Note. |
| [12] | ONRW-2126615823-838, CASTOR - Shielding Technical Assessment Note. |
| [13] | ONRW-2019369590-3235, SCR Assessment. |
| [14] | ONRW-2126615823-101, GB5125 - Human Factors Assessment AcpR. |