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| ONR Project assessment report  PR-01604: GB/5131/AF Validation – Fissile validation of USA/9342/AF-96, Revision 7 |



ONR Project assessment report

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**Dutyholder/Applicant**: Orano TN - USA

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# Executive summary

In January 2024, Orano TN USA (the applicant), applied to the Office for Nuclear Regulation (ONR) for a GB validation approval of USA/9342/AF Rev.7. The previous validation (GB/5131/AF Rev.0) expired on 31/05/2024.

The USA/9342/AF (known as the Versa-Pac) is designed for the transport of miscellaneous unirradiated uranium materials, covering a range of physical and chemical forms, including fuel materials, over a range of enrichments up to and including highly enriched uranium.

The USA/9342/AF has been approved by the US competent authority, the Department of Transportation. As a fissile package, this approval is supported by a certificate of compliance from the US Nuclear Regulatory Commission as per their national arrangements. We first validated the USA/9342 package design in 2022.

There are two different models available, these being the Versa-Pac VP-55 and VP-110, i.e. 55-gallon and 110-gallon outer drums. The applicant is seeking validation in the UK for the VP-55 model only, excluding uranium hexafluoride 1S and 2S cylinders and use of the High-Capacity Basket. The requested validation scope is therefore unchanged from our previous validation in 2022.

ONR conducted a proportionate assessment of the transport safety case contained in the application. There have been no changes to the design of the packages since the previous validation.Engineering, shielding and criticality aspects of the safety submission were sampled, targeting changes in regulations since the previous validation.

Following the programme of assessment, it was concluded that the safety submission from the applicant is adequate and meets applicable regulatory requirements.

It is recommended that the transport competent authority validates USA.9342/AF (Rev.7) by renewing GB/5131 to (Rev.1). GB/5131 (Rev.1) should state that the use of the VP-110 Model package, the transport of uranium hexafluoride 1S and 2S cylinders and use of the HCB are not permitted and that restricting the authorised contents to exclude reprocessed uranium is no longer required.

Due to differences between USA/9342/AF Rev.7 and the application made (exclusion of VP-110 and high-capacity basket), ONR produced a certificate for GB/5131/AF at Rev.1 rather than a standard validation. The certificate captures the UK competent authority requirements, without the need to reference the USA certificate of approval.

Table 1: List of abbreviations.

|  |  |
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| Term/Acronym | Description |
| HOW2 | (Office for Nuclear Regulation) business management system |
| IAEA | The International Atomic Energy Agency |
| ONR | Office for Nuclear Regulation |
| SSR | Specific Safety Requirements |
| TCA | Transport Competent Authority |
| UK | United Kingdom |

Table of contents

[Executive summary 4](#_Toc172642355)

[1. Permission requested 7](#_Toc172642356)

[2. Background 7](#_Toc172642357)

[3. Assessment and inspection work carried out by ONR in consideration of this request 8](#_Toc172642358)

[3.1. Engineering Assessment [4] (AR-01426) 8](#_Toc172642359)

[3.2. Criticality Assessment [7] (AR-1423) 9](#_Toc172642360)

[3.3. Shielding Assessment [10] (AR-1424) 9](#_Toc172642361)

[4. Matters arising from ONR’s work 10](#_Toc172642362)

[5. Conclusions 10](#_Toc172642363)

[6. Recommendations 10](#_Toc172642364)

[References 11](#_Toc172642365)

# Permission requested

1. Orano TN USA (the applicant), applied to the Office for Nuclear Regulation (ONR) for a GB validation approval [1] of USA/9342/AF Rev.7 [2].
2. This report presents the basis of the regulatory decision by ONR, as Great Britain competent authority for the transport of Class 7 (radioactive material) dangerous goods, to validate the USA/9342/AF Rev.7 certificate.

# Background

1. The USA/9342/AF (known as the Versa-Pac) is designed for the transport of miscellaneous unirradiated uranium materials, covering a range of physical and chemical forms, including fuel materials, over a range of enrichments up to and including highly enriched uranium.
2. The USA/9342/AF has been approved by the US competent authority, the Department of Transportation. As a fissile package, this approval is supported by a certificate of compliance from the US Nuclear Regulatory Commission as per their national arrangements. We first validated the USA/9342 package design in 2022.
3. The USA/9342 is a drum-type package approved as a Type AF design for the transport of unirradiated solid and non-pyrophoric uranium materials. The design concept comprises an inner container for payload containment, surrounded by ceramic fibre and rigid polyurethane insulation. This is held centrally within an outer drum, with manufactured features that provide structural stiffening for the package.
4. There are two different models available, these being the Versa-Pac VP-55 and VP-110, i.e. 55-gallon and 110-gallon outer drums. Validation is being sought in the UK for the VP-55 model only, excluding uranium hexafluoride 1S and 2S cylinders and use of the High-Capacity Basket (HCB). The requested validation scope is therefore unchanged from our previous validation and shielding assessment in 2022.
5. Full details of the package design are given in the package safety analysis report [3].

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

1. There have been no changes to the VP-55 design. The application contains updates to supporting documentation.
2. USA/9342/AF-96 has been updated to revision 6 and 7 since the previous GB validation. This was due to organisational changes and inclusion of high-capacity basket (which is outside the scope of this validation). The applicant’s quality assurance program [4] has been approved by the United States Nuclear Regulatory Commission which underpins the current base approval [2]. Therefore, I judge that a safety case requirements assessment is not required. I also consider it to be disproportionate to undertake any inspection work unless any significant gaps are identified during the assessment process.
3. We conducted a proportionate assessment of the transport safety case contained in the application. We identified that areas of engineering, criticality and shielding require assessment.
4. Our assessments were undertaken in accordance with the requirements of ONR How2 Business Management System and its associated guidance.

## Engineering Assessment [5] ([AR-01426](https://prodonrgov.sharepoint.com/can_assessment/AR-01426_Internal_Only/VP-55%20Engineering%20Assessment%20Note%20updated%20for%20aging%20mechanisms.docx))

1. The scope of our engineering assessment focused on the changes that have been made since the last renewal in Jan 2022. These relate to the updated version of SSR-6 2018. This requires ageing mechanisms to be considered.
2. In response to our engineering Q1 questions [6] on ageing management, the applicant provided additional documentation [7]. This document divides all the packaging parts of the Versa-Pac up into material categories and outlines the different potential ageing mechanisms and what considerations are made for each. The applicant concludes that due to low radiation emissions of the package, deterioration from radiation and/or high heat loads have not been considered. We judged this to be reasonable. The primary ageing mechanisms considered are corrosion, fatigue, and wear. Periodic and pre-shipment inspections are completed with components repaired/replaced as required. The package is protected by the outer parts of the package with the outer surfaces covered with paint. We judged that this meets the expectations of paragraph 613A of SSR-6 2018.
3. We recommend, from a mechanical engineering perspective, the USA/9342/AF package design is approved.

## Criticality Assessment [8] ([AR-1423](https://prodonrgov.sharepoint.com/can_assessment/AR-01423_Internal_Only/2024%2023273%20-%20USA9342%20-%20Technical%20Note%20-%20Criticality%20Assessment%20of%20USA9342-AF%20GB5131-AF.docx))

1. We reviewed the applicant’s criticality assessment [9]. This has been updated to include details on the HCB since our last assessment in 2022 [10]. However, this is outside the scope of the applicant’s request. Our previous criticality assessment [10] identified a minor technical issue that we expected to be resolved by the applicant during this application. In response, the applicant adopted a two-stage approach to the assessment of temperature effects on reactivity, comprising a qualitative assessment supported by calculations using the Monte Carlo N-Particle Transport (MCNP) computer code. Therefore, we targeted the following areas:

* Qualitative Argument – We consider the qualitative argument is of technical interest, but its value is limited and outweighed by the calculational assessment provided.
* Codes and Nuclear Data - We consider this is an adequate analysis tool and judge the baseline assessment to be appropriate.
* Code Validation - We judged that the extrapolation of reactivity trends to estimate Δkeff represents suitable and appropriate assessment, consistent with our regulatory expectations.
* Criticality Calculations - we judged that the applicant has undertaken an adequate assessment of the impact of temperature on reactivity. This covers the ambient temperature range that may be experienced during transport.

1. We recommend, from a criticality safety perspective, that the USA/9342/AF package design is approved until 31 October 2027 in line with the base certificate of approval from the USA competent authority. However, as the applicant has requested that the Versa-Pac VP-110 variant and the transport of uranium hexafluoride 1S and 2S cylinders and the use of the HCB are excluded from our review, it is not possible to validate the US CAC, USA/9342/AF-96 Revision 7 in full. For this reason, we recommend that this multi-lateral approval is effected by the issue of a revised GB certificate of approval GB/5131/AF which states that the use of the VP-110 Model package, the transport of uranium hexafluoride 1S and 2S cylinders and use of the HCB is not permitted.

## Shielding Assessment [11] ([AR-1424](https://prodonrgov.sharepoint.com/can_assessment/AR-01424_Internal_Only/2024%2016346%20-%20USA9342%20-%20Technical%20Note%20-%20Shielding%20Assessment%20of%20USA9342-AF%20GB5131-AF.docx))

1. We reviewed the applicant’s radiation shielding assessment [9]. This has been updated to include details on the HCB since our last assessment in 2022 [12]. However, this is outside the scope of the applicant’s request. The radiation shielding assessment in [9] shows that the maximum dose rates on the package surface and at 1 m distance are 49.9 mSv/h and 2.3 mSv/h respectively. The dose rates are dominated by gamma radiation, which typically comprises ~90% of the total dose rate. Therefore, we targeted the following areas:

* Source Specification - We judged that the previous restriction in the GB/5131/AF certificate of approval regarding reprocessed uranium can now be removed.
* Shielding Calculations - All shielding calculations were performed using MCNP6.1 with the standard MCPLIB84 and ENDF71x nuclear data libraries for gamma and neutron radiation respectively. We consider this to be an appropriate assessment method.
* Calculated Dose Rates - The applicant’s shielding assessment has used ANS/ANSI-6.1.1-1977 gamma and neutron fluence-to-dose conversion factors [13]. The maximum dose rates at 0 m and 1 m from the package surface are 49.9 mSv/h and 2.3 mSv/h respectively. These are approximately forty times lower than the statutory limits (as per SSR-6 para 566 (b) and para 659 (b)).

1. We recommend, from a shielding perspective, that the USA/9342/AF package design is approved until 31 October 2027 in line with the base certificate of approval from the USA competent authority. However, as the applicant has requested that the Versa-Pac VP-110 variant and the transport of uranium hexafluoride 1S and 2S cylinders and the use of the HCB are excluded from our review, it is not possible to validate the US CAC, USA/9342/AF-96 Revision 7 in full. For this reason, we recommend that this multi-lateral approval is affected by the issue of a revised GB certificate of approval GB/5131/AF which states that the use of the VP-110 Model package and the transport of uranium hexafluoride 1S and 2S cylinders and use of the HCB is not permitted. Furthermore, we recommend that restricting the authorised contents to exclude reprocessed uranium is no longer required.

# Matters arising from ONR’s work

1. Due to differences between USA/9342/AF Rev.7 [2] and the application made (exclusion of VP-110 and high-capacity basket). We have produced a certificate for GB/5131/AF at Rev.1 replacing the previous validation. The certificate captures the UK competent authority requirements, without the need to reference the USA certificate of approval.

# Conclusions

1. Based on the work conducted, I am satisfied that the safety submission from the applicant is adequate and meets applicable regulatory requirements.

# Recommendations

1. I recommend the transport Competent Authority approves the validation for USA/9342/AF Rev.7 by issuing a GB/5131/AF certificate to Rev.1 expiring on 31/10/2027.

# References

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| [1] | Orano TN, “E-63205 ONR Validation Transmittal Letter, ONRW-2019369590-7401”. |
| [2] | US DOT, “E-63205 Encl 1 - U.S. DOT Competent Authority Certification USA\_9342\_AF-96-96 R7 w cover.pdf, ONRW-2019369590-7402”. |
| [3] | Orano TN, “Versa-Pac Transportation Package Safety Analysis Report, Revision 13, December 2021 - ONRW-2019369590-7407”. |
| [4] | Orano TN, “VP55 -Quality Assurance Documentation - ONRW-2019369590-7879”. |
| [5] | ONR, “VP55 Engineering Assessment Note - ONRW-2126615823-3596”. |
| [6] | ONR, “Q1 Assessment Review Form - ONRW-2126615823-2678”. |
| [7] | Orano TN, “VP-55 Ageing Management Summary, Revision 0, VP-EE-001 – ONRW-2126615823-3580”. |
| [8] | ONR, “USA9342 - Technical Note - Criticality Assessment of USA9342-AF GB5131-AF - ONRW-2126615823-3326”. |
| [9] | Orano TN, “Calculation VP-0601 Rev 0, "Versa-Pac Responses - Criticality Temperature and External Dose Rates", Calculation VP-0601 Rev 0, "Versa-Pac Responses - Criticality Temperature and External Dose Rates", January 2024, WIReD Ref: ONRW-2019369590-7404”. |
| [10] | ONR, “"Criticality Safety Assessment of the USA/9342/AF-96 Package in Support of Validation of Foreign Certificate", December 2022, CM9 Ref: 2022/49523.”. |
| [11] | ONR, “USA9342 - Technical Note - Shielding Assessment of USA9342-AF GB5131-AF - ONRW-2126615823-3288”. |
| [12] | ONR, “"Radiation Protection - Shielding/Dose Rate Assessment USA/9342/AF GB/5131/AF - Versa-Pac", October 2022, CM9 Ref: 2022/5917”. |
| [13] | ANS/ANSI-6.1.1-1977, “Neutron and Gamma Flux-to-Dose Conversion Factors", 1977.”. |