



Transport of Radioactive Material in the UK using the TNF-XI Package Design

Application for United Kingdom Validation of French Certificate of Approval F/381/AF-96 (Dk) for the TNF-XI Package (SVC4386311)

Project Assessment Report ONR-SDFW-PAR-18-041
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EXECUTIVE SUMMARY

Application for United Kingdom Validation of French Certificate of Approval F/381/AF-96 (Dk) for the TNF-XI Package (SVC4386311)

This report summarises the basis of the regulatory decision by the Office for Nuclear Regulation (ONR) as Great Britain (GB) Competent Authority (CA) for Class 7 (radioactive material) dangerous goods, to validate the French Competent Authority Certificate of Approval (CoA) F/381/AF-96 (Dk) for the ORANO TN TNF-XI transport package design.

Permission Requested

The Applicant, ORANO TN has written to ONR to request validation of the French CA CoA F/381/AF-96 (Dk) to allow use of the package in the United Kingdom (UK). This validation request was made under provision 6.4.22.4 of the following modal regulations to allow transport by road, rail and sea:

- European Agreement Concerning the International Carriage of Dangerous Goods by Road, ADR;
- Regulations concerning the International Carriage of Dangerous Goods by Rail, RID;
- International Maritime Dangerous Goods Code, IMDG.

The above modal regulations are based on the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, currently SSR-6 (2012 Edition) supported by advisory material in SSG-26.

Under these modal regulations, fissile material package designs to be used in different countries require multi-lateral approval. This may be by validation of the original certificate issued by the CA of the country of origin of the package design or shipment, or the issue of a separate certificate of approval.

Background

The TNF-XI transport package is used by a UK based duty holder and is currently approved for transport contents n°2, n°4 and n°7 via road, rail and sea in the UK under certificates of approval, GB/5108A/AF-96 (Rev.1) and GB/5108A/IF-96 (Rev.4). Contents n°2, n°4 and n°7 consist of uranium oxides ($\leq 5\text{wt.}\%$ enrichment) in the form of powder, pellets or scraps and may be contaminated by residues. These approvals are based on the Safety Analysis Report (SAR) DOS-06-00037028-000 Revision 7.

A duty holder based in Japan, Nuclear Fuel Industry (NFI) who are the main user of the TNF-XI package would like to use the TNF-XI package to transport uranium in the form of oxides or other uranium complexes possibly contaminated by residues. The Package Design Authority, ORANO TN has obtained approval for this new content (content n°8) from the French Competent Authority: F/381/AF-96 (Dk) dated 9 April 2018 (covering content n°8).

As it is intended to use the TNF-XI package to transport fissile content n°8 in the UK, ORANO TN have submitted an Application requesting package design approval from ONR.

The safety justification for the transport package is contained in an updated SAR, DOS-06-00037028-000 Revision 9 and note NTE-18-005200-000 Version 2. These have been submitted to and assessed by ONR.

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

ONR carried out a programme of work in consideration of this request which involved assessment of the Applicant's safety case, its claims, arguments, supporting documentation and evidence, with particular attention given to the new content n°8. The assessment focused on key package safety functional areas of criticality, engineering and shielding of the package, its use and any issues that have arisen since the previous CoAs for the other contents (n°2, n°4 and n°7) were granted.

No inspection work was conducted explicitly in support of this application. Regulatory confidence is drawn from recent inspection history of the UK based duty-holder (the package consignee with respect to content °8), approval from the originating CA, and written correspondence from the applicant to establish specific details relevant to this application as well as correspondence from the consignor, NFI, based in Japan.

Matters arising from ONR's work

None.

Conclusions

Based on the sampling undertaken I am satisfied with the claims, arguments and evidence within the safety case documentation and conclude that content n°8 in the TNF-XI package design F/381/AF-96 (Dk) is judged to be safe and meets the regulatory requirements detailed within ADR, RID and IMDG (and also SSR-6).

Recommendation

It is recommended that the TNF-XI package containing content n°8 is approved for transport in the UK by road, rail and sea through validation of the French Certificate of Approval F/381/AF-96 (Dk).

LIST OF ABBREVIATIONS

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
ASN	Autorité De Sûreté Nucléaire
CA	Competent Authority
CDG	The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations
CoA	Certificate of Approval
DCI	Deputy Chief Inspector
DL	Delivery Lead
GB	Great Britain
HOW2	(ONR) Business Management System
IAEA	International Atomic Energy Agency
IMDG	International Maritime Dangerous Goods Code
NFI	Nuclear Fuel Industry
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
SAR	Safety Analysis Report
SDFW	Sellafield, Decommissioning, Fuel & Waste
SI	Superintending Inspector
SSG	(IAEA) Specific Safety Guide
SSR	(IAEA) Specific Safety Requirements
UK	United Kingdom
wt.%	Percentage by weight

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1 PERMISSION REQUESTED

1. The Applicant, ORANO TN has written to the Office for Nuclear Regulation (ONR) to request validation of the French Competent Authority (CA) Certificate of Approval (CoA): F/381/AF-96 (Dk) to allow transport of the TNF-XI package carrying content n°8 by road rail and sea in the United Kingdom (UK).

2 BACKGROUND

2. There are certain transport package designs carrying Class 7 (radioactive material) dangerous goods that require CA approval. For example, all packages containing fissile material (that are not classed as fissile excepted) require multilateral approval, i.e. approval by the relevant CA of the country of origin of the design, and also, where the consignment is to be transported through or into any other country, approval by the CA of that country.
3. ONR is the Great Britain (GB) CA for the civil inland surface transport of Class 7 (radioactive material) dangerous goods. This statutory duty is given to ONR through The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG) [1]. In accordance with Agency Agreements (legal documents used to transfer statutory responsibilities between bodies) [2] ONR also acts on behalf of other civilian UK CAs in cases where CA approval of a package design is required; namely:
 - The Competent Authority of the United Kingdom of Great Britain and Northern Ireland in respect of sea transport, being the Secretary of State for Transport including the Maritime and Coastguard Agency;
 - The Competent Authority of the United Kingdom of Great Britain and Northern Ireland in respect of air transport, being the Civil Aviation Authority; and
 - The Competent Authority of Northern Ireland in respect of road transport, being the Department of Agriculture, Environment and Rural Affairs - Northern Ireland.
4. ORANO TN based in France, is the design authority for the TNF-XI transport package which is used to transport fissile radioactive material. The TNF-XI package model is currently used to transport uranium oxides (UO₂, UO₃ or U₃O₈) with a U-235 enrichment of no more than 5 weight percent U-235 in total U. The uranium oxides are in the form of powder, pellets or scraps and may be contaminated by residues. There are two package variations, a Type A (carrying content n°4) and an Industrial Package Type 2 (carrying content n°2 or n°7), both of which are fissile packages. Both package variants have been approved for use in France by the French CA, Autorité De Sûreté Nucléaire (ASN) under certificates of approval:
 - F/381/AF-96 (Di) dated 6 September 2016 (covering contents n°2 and n°7) [3]
 - F/381/IF-96 (Dj) dated 6 September 2016 (covering content n°4) [4]
5. These approvals are based on the Safety Analysis Report (SAR) DOS-06-00037028-000 Revision 7 [5].
6. The TNF-XI transport package is used by a UK based duty holder and is currently approved for transport via road, rail and sea in the UK under certificates of approval, GB/5108A/AF-96 (Rev.1) [6] and GB/5108A/IF-96 (Rev.4) [7]. These UK approvals were also based on SAR DOS-06-00037028-000 Revision 7 [5] plus some additional criticality documentation:
 - CEX 16 00178947 002 [8]
 - CEX 16 00178947 003 [9]

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- CEX 16 00178947 004 [10]
 - NTC-17-00194972-000 Rev.0 [11]
7. A duty holder based in Japan, Nuclear Fuel Industry (NFI) who are the main user of the TNF-XI package would like to use the TNF-XI package to transport uranium in the form of oxides or others uranium complexes possibly contaminated by residues. The Applicant (ORANO TN) has obtained approval for this new content (content n°8) from the French Competent Authority:
- F/381/AF-96 (Dk) dated 9 April 2018 (covering content n°8) [12].
8. The above approval is based on the Safety Analysis Report DOS-06-00037028-000 Revision 9 [13] and note NTE-18-005200-000 Version 2 [14].
9. As it is intended to use the TNF-XI package to transport fissile content n°8 in the UK, ORANO TN have submitted an Application [15] requesting package design approval from ONR (the CA) as required under provision 6.4.22.4 of the following modal regulations to allow transport by road, rail and sea:
- European Agreement Concerning the International Carriage of Dangerous Goods by Road, ADR [16];
 - Regulations concerning the International Carriage of Dangerous Goods by Rail, RID [17];
 - International Maritime Dangerous Goods Code, IMDG [18].
10. The above modal regulations are based on the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, currently SSR-6 (2012 Edition) supported by advisory material in SSG-26 [19].
11. Approval may be effected by validation of the original certificate issued by the CA of the country of origin of the package design or, the issue of a separate certificate of approval.
12. This ONR Project Assessment Report (PAR) presents the findings of the assessment of the application for validation of package design approval of the TNF-XI, F/381/AF-96 (Dk) [15] (including the Safety Analysis Report (SAR), DOS-06-00037028-000 Revision 9 [13]).

3 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST

13. This current application has been considered in accordance with ONR's assessment processes [20]. ONR carried out a detailed programme of work [21 – 28] that involved the assessment of the Applicant's transport safety case, supporting documentation and evidence, and the mechanisms for its implementation via the relevant management systems.
14. The package design under assessment is a Type A Fissile Package, hence the designation F/381/AF-96. In accordance with para 802 and Annex I of SSR-6, Competent Authority approval is only required owing to the fissile aspect of the package, i.e. Competent Authority approval is not required for Type A package designs containing non-fissile material (instead subject to self-assessment). Thus, multilateral approval is only required because the packages are fissile packages (potential criticality hazard).
15. In addition, in relation to validation of CoA, para 840.1 of SSG-26 states 'Competent authorities, other than that of the country of origin, have the option of either performing a separate safety assessment and evaluation or making use of the assessment

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already made by the original competent authority, thus limiting the scope and extent of their own assessment'. Cognisance was taken that:

- the package has been approved by the French CA (with whom, until recently we maintained a Memorandum of Understanding which allowed ONR to give multilateral approval of cases approved by the French without detailed assessment by ONR);
 - there is confidence in the Applicant's process for producing transport safety cases and their track record;
 - the package is not novel or complex, and the package is already approved in the UK for contents n°2, n°4 and n°7 following rigorous assessment by ONR:
 - For package approval renewal in 2016, see ONR-COP-PAR-16-023 [29];
 - For a modification to the package approval in 2017, see ONR-SDFW-PAR-17-051 [30].
 - New content n°8 is very similar to approved content n°7 and the criticality safety case closely follows the same methodology and assumptions.
16. Therefore, a proportionate assessment approach was adopted which focused mainly on the criticality analysis (as this is the reason that CA approval is required) and any engineering/ administrative aspects which influence the criticality assessment, as well as changes since the last approval i.e. inclusion of content n°8, and any relevant findings and outcomes from previous ONR assessments.

3.1 CRITICALITY ASSESSMENT [25]

17. The criticality assessment [25] focused on confirming that the applicant's modelling approach for new content n°8 is suitably conservative and representative of the conditions expected in the relevant transport regulations [16, 17, 18]. Particular scrutiny was applied to the underpinning assumptions concerning the fissile material form and moderator/ reflector content and modelling uncertainties.
18. In addition, consideration of the effect of temperature on criticality calculations at low and elevated temperatures is an emergent issue in transport criticality assessment. Historically, criticality safety cases have used nuclear data at room temperature (~20°C). However, recent work has suggested that changes in temperature may have the potential to increase reactivity. Thus, specific attention was given to neutron multiplication variation over the temperature range specified in the relevant transport regulations [16, 17, 18] (-40°C to +38°C, or the maximum package temperature resulting from the thermal tests if greater than +38°C).
19. On the basis of the assessment carried out and subsequent review of the additional evidence provided by the applicant, ONR judges that an adequate criticality safety case, with suitable conservatism and bounding content justification, for the TNF-XI package with the specified contents has been presented for content n°8. The defined fissile and moderator limits are adequately underpinned for the normal conditions of transport and accident conditions covering the full temperature range required by the regulations. The derived Criticality Safety Index value of 0 is appropriate for this package, subject to the defined package limits being met. Therefore, validation of F/381/AF-96 (Dk) was supported by the ONR criticality assessor.

3.2 ENGINEERING ASSESSMENT [26]

20. The ONR engineering assessment [26], focused on consideration of the aspects that had been updated since the last GB approval for the TNF-XI package [6, 7] and ensured the new content, n°8, was bounded by engineering substantiation previously performed. It was concluded that there were no engineering concerns and that the

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form and mass limits of the new contents do not invalidate conclusions of the previous ONR's previous engineering assessment [31] reviewed against relevant regulatory requirements of IAEA SSR-6 [19]. Validation of F/381/AF-96 (Dk) was therefore supported by the ONR engineering assessor.

3.3 SHIELDING ASSESSMENT [27]

21. The ONR shielding assessment [27] targeted the Applicants shielding assessment (DOS-06-00037028-400, Revision 3) Section of the SAR [13] which summarises the methods, data and results of dose rate calculations undertaken for previously approved contents (n°2, n°4 & n°7) and additional contents n°8 (the latter being the subject of this application). ONR's shielding assessment found that the Applicant's modelling assumptions are sufficiently conservative to provide upper bound dose rate estimates. The dose rates for contents type n°8 (maximum dose rate of 0.05 mSv/h) are an order of magnitude less than those calculated for the previously approved contents types (based on bounding content n°4). This is largely due to any adverse changes in source term and geometry for contents type n°8 being offset by the much reduced mass of un-irradiated material for content n°8 compared to the bounding dose rates for content n°4. Thus the Applicants shielding assessment adequately confirms that the dose rates for content n°8 are bounded by those assessed and previously approved by ONR [29]. The shielding assessment concluded that the application is acceptable and validation of F/381/AF-96 (Dk) from a shielding and dose rate perspective was recommended.

3.4 SAFETY CASE REQUIREMENTS (SCR) ASSESSMENT [28]

22. The ONR safety case requirements assessment [28] assessed the management system arrangements for implementation of the requirements of the transport package safety case. As the package will be used to transport content n°8 from Japan to the dutyholders in the UK will be as a carrier and consignee. A previous inspection was carried out on 16 March 2017: ONR-COP-IR-16-067 [32]. This looked specifically at the dutyholders management arrangements for the TNF-XI package and emergency arrangements. The inspection concluded the dutyholders arrangements in respect of provision 1.7.3 of ADR (and equivalent provisions in other modal texts) [16-18] were considered adequate for the purposes of transporting radioactive material. Based on the nature of the application described above and the findings from the 2017 inspection, a further inspection was not considered necessary in support of this particular application.
23. The SCR assessment gained confidence in the overseas dutyholders capability to implement the requirements of the safety case / certificate of approval. Justification and clarification received from the Japanese consignor allowed all queries to be followed through to acceptable conclusions. Further regulatory confidence was gained from the issue of an approval by the French CA. Consequently, ONR is content that there are no outstanding safety matters in the context of this aspect of the assessment. On-going compliance with the requirements of the certificate of approval is examined through routine interactions with the consignor.

4 MATTERS ARISING FROM ONR'S WORK

24. None.

5 CONCLUSIONS

25. This report presents the findings of the ONR assessment of the adequacy of ORANO TN's application [15] for validation of certificate F/381/AF-96 (Dk) [12] (covering

content n°8) issued by the French Competent Authority for the TNF-XI package and supporting documentation including the SAR [13].

26. These documents have been judged against the requirements of the IAEA Regulations for the Safe Transport of Radioactive Material, SSR-6, 2012 Edition [19], as implemented in UK law via ADR, RID and IMDG [16, 17, 18] for carriage by road, rail and sea respectively.
27. I am satisfied with the claims, arguments and evidence laid down within the Applicant's safety case documentation and consider that the application demonstrates the package design meets the requirements of SSR-6 [19] and hence those in ADR, RID and IMDG [16, 17, 18].

6 RECOMMENDATIONS

28. It is recommended that the TNF-XI package containing content n°8 is approved for transport in the UK by road, rail and sea through validation of the French Certificate of Approval F/381/AF-96 (Dk) [12].

7 REFERENCES

1. The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (CDG) 2009, (SI 2009 No. 1348).
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 - Agreement with Department of Agriculture Environment & Rural Affairs (DAERA) (Northern Ireland) - <http://www.onr.org.uk/documents/2014/transport-aa-northern-ireland.pdf>
 - Agreement with Secretary of State for Transport (including the MCA) - <http://www.onr.org.uk/documents/2014/mca-aa.pdf>
 - Agreement with the Civil Aviation Authority - <http://www.onr.org.uk/documents/2014/caa-aa.pdf>
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12. F/381/AF-96 (Dk): 'Certificat D'Agrement D'Un Modele De Colis' Autorité De Sûreté Nucléaire, 9 April 2018. Attachment to TRIM Record: 2018/203053. [English Translation: F/381/AF-96 (Dk): 'Certificate of Approval of a Package Model', Autorité De Sûreté Nucléaire, 9 April 2018. Attachment to TRIM Record: 2018/203053].
13. DOS-06-00037028 000 Revision 9: 'Safety Analysis Report TNF-XI', AREVA TN International, 1 June 2017. TRIM Record: 2018/364846.
14. NTE-18-005200-000 Version 2: 'Allowed Hazardous Material, class 7 Excluded, in the TNF-XI Package', 23 February 2018. TRIM Record: 2018/203053.

15. COR-18-008895-000: 'Transport of Radioactive Material Package model F/381/AF-96 and F/381/IF-96 – TNF-XI Package Application for United Kingdom validation of French certificate of approval F/381/AF-96 (Dk)', ORANO TN, 13 June 2018. TRIM Record: 2018/203053.
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17. Intergovernmental Organisation for International Carriage by Rail (OTIF), Regulations concerning the International Carriage of Dangerous Goods by Rail (RID) 2019 Edition. www.otif.org
18. International Maritime Dangerous Goods Code (IMDG) 2018 Edition incorporating Amendment 39-18.
19. IAEA Safety Standards:
SSR-6, 'Regulations for the Safe Transport of Radioactive Material (2012 Edition)', IAEA, Vienna, 2012.
SSG-26, 'Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material (2012 Edition)', IAEA, Vienna, 2012.
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22. F/381 (SVC4386311) - Pre-Job Brief - Validation, TNF-XI package F/381/AF-96 (Dk) - Orano - 13 December 2018. TRIM Record: 2018/356121.
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