

# **Safety Analysis Report Safkeg-HS Design No. 3977A Package Docket 71-9338**



**Application for Approval by the NRC**

**Applicant: Croft Associates Limited**

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### 0 SARP STATUS AND CONTENTS

This Safety Analysis Report for Packaging (SARP) has been prepared by Croft Associates Ltd for the new approval of the SAFKEG-HS Design No. 3977A transport package as a Type B(U) design.

This section (Section 0) defines the document status and lists the contents of the SARP (SARP sections and appended documents included in the SARP).

This SARP is a controlled document under the Croft Associates Ltd Quality Assurance Program approved by the NRC under Approval Number 71-9338.

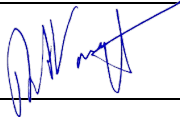

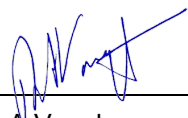
Revisions to the SARP are on a document control basis, with revisions at each update normally being indicated by a vertical change bar in the right hand margin.

Reference documents, which are listed in the Appendices to each section, are those available in the general literature and are not provided in the SARP.

Supporting documents are those developed specifically for the SARP and are provided in the section that is most closely associated with the document. These supporting documents are listed in this section, together with their revision status.

Document control for the supporting documents which have been produced by different organizations at different times with different styles, is established by reference designations and issue status and/or date: there is no significance in the various policies of adding the names of author, checker or approver or whether they are manually or electronically signed.

## 0.1 SARP REVISION STATUS

Title	SAFKEG-HS 3977A Docket No. 71-9338	Number	CTR 2008/11
		Issue	Revision 15
		File Reference	CTR2008-11-R15-Sc0-v3-r.docx
Compiled		Checked	
	R A Vaughan		A L Ferguson
Approved		Date	30 July 2019
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## 0.2 SUPPORTING DOCUMENT REVISION STATUS

Page/Document Reference	Issue Status	Title
<b>Section 0 – SUPPORTING DOCUMENT REVISION STATUS</b>		
Pages 0-1 to 0-9	Rev15	
<b>Section 1 - GENERAL INFORMATION</b>		
Pages 1-1 to 1-47	Rev 15	
<b>Documents in Section 1.3 Appendix</b>		
<b>Documents in Section 1.3.2 Calculation Model Drawings</b>		
0C-5949	Issue A	Safkeg-HS Construction
1C-5997	Issue A	Containment Vessel HS Lid Construction
1C-5999	Issue A	Containment Vessel HS Body Construction
3C-6850	Issue A	HS-12x95-Tu Insert Design No. 3982 (construction)
3C-6851	Issue A	HS-31x114-Tu Insert Design No. 3985 (construction)
3C-6852	Issue A	HS-55x128-SS Insert Design No. 3987 (construction)
<b>Documents in Section 1.3.3 Licensing Drawings</b>		
<b>Safkeg-HS Design No. 3977A</b>		Single Lid Version
1C-5940	Issue H	Cover sheet for Safkeg-HS Design No. 3977A (licensing drawing)
0C-5941	Issue E	Safkeg-HS Design No. 3977A (licensing drawing)
0C-5942	Issue C	Keg Design No. 3977 (licensing drawing)

Page/Document Reference	Issue Status	Title
0C-5943	Issue B	Cork set for Safkeg-HS (licensing drawing)
1C-5944	Issue C	Containment vessel Design No. 3978 (licensing drawing)
1C-5945	Issue D	Containment vessel lid (licensing drawing)
1C-5946	Issue E	Containment vessel body (licensing drawing)
2C-6173	Issue D	HS-12x95-Tu Insert Design No 3982 (Licensing drawing)
2C-6174	Issue D	HS-31x114-Tu Insert Design No 3985 (Licensing drawing)
2C-6176	Issue F	HS-55x128-SS insert Design No 3987 (licensing drawing)
2C-6920	Issue A	Silicone Sponge Rubber Disc
<b>Safkeg-HS Design No. 3977A</b>		Split Lid Mallinckrodt Version
1C-7500	Issue C	Cover sheet for Safkeg-HS Design No. 3977A - Mallinckrodt Version
0C-7501	Issue C	Safkeg-HS Design No. 3977A - Mallinckrodt Version
0C-7502	Issue A	Keg Design No. 3977 - Mallinckrodt Version
0C-7503	Issue A	Cork set for Safkeg-HS - Mallinckrodt Version
1C-7504	Issue A	CV Design No. 3978 - Mallinckrodt Version
1C-7505	Issue A	CV lid - Mallinckrodt Version

Page/Document Reference	Issue Status	Title
1C-7506	Issue A	CV body - Mallinckrodt Version
1C-7507	Issue A	Containment vessel plug – Mallinckrodt version
2C-7508	Issue C	HS-50x85-SS insert Design No 4081
2C-7509	Issue B	Snap Ring
2C-7510	Issue A	Tungsten Liner
<b>Safkeg-HS Design No. 3977A</b>		Split Lid with Insert 4109
1C-7940	Issue B	Cover sheet for Safkeg-HS Design No. 3977A
0C-7941	Issue B	Safkeg-HS Design No. 3977A
0C-7942	Issue B	Keg Design No. 3977
0C-7943	Issue B	Cork set for Safkeg-HS
1C-7944	Issue B	CV Design No. 3978
1C-7945	Issue B	CV lid
1C-7946	Issue B	CV body
1C-7947	Issue C	Containment vessel plug
2C-8094	Issue A	HS-55x113-ss SS insert Design No 4109

Page/Document Reference	Issue Status	Title
2C-8090	Issue A	Silicone Sponge Rubber Disc
1C-7975	Issue B	Packing for Thorium Target in Design No. 3978
<b>Documents in Section 1.3.4 Supporting Documents</b>		
PCS 038	Issue J	Package Contents Specification for Safkeg-HS - Package Design No 3977A
<b>Section 2 - STRUCTURAL EVALUATION</b>		
Pages 2-1 to 2-62	Rev 14	
<b>Documents in Section 2.12.2, Appendix</b>		
CTR 2010/02	Issue A	Prototype Safkeg-HS 3977A/0002 NCT and HAC Regulatory Test Report
SERCO/TAS/002762/01	Issue 1	Compression Testing of Cork
Vectra, L20008/1/R1	Rev 0B	Stress Analysis of Safkeg HS 3977A Containment Vessel
CS 2012/02	Issue A	SAFKEG HS 3977A – Maximum Pressure in CV
CS 2012/03	Issue A	SAFKEG HS 3977A – Package Density
<b>Section 3 - THERMAL EVALUATION</b>		
Pages 3-1 to 3-23	Rev 14	
<b>Documents in Section 3.5.2, Appendix</b>		
AMEC/6335/001	Issue 1	Thermal Analysis of the Safkeg HS Design
CS 2012/01	Issue A	SAFKEG HS 3977A – Maximum Temperature of CV Inserts

Page/Document Reference	Issue Status	Title
CS 2016/31	Issue A	Maximum Pressure in Containment Vessel 3978 Under NCT and HAC
CS 2019-02	Issue A	Safkeg-HS - Gas generated by radiolysis of moisture in the air
ETR 426 Filename: 06 I131 MURR Report	23 Nov 13	Hydrogen Generation Analysis, MURR Technical Note
ETR 427 Filename: 07 Hydrogen Ignition Review RAI 3_2	2 Apr 16	Analysis Of The Possibility Of, And Consequences From, Hydrogen Deflagration And Detonation Resulting From Radiolysis-Produced Hydrogen In An Iodine-131 Radiopharmaceutical Solution, MURR
ETR 428 Filename: MURR Gas gen report	19 Jul 16	Additional Contents Request for Croft Packaging, MURR
CS 2016/27	Issue A	Temperature of Mo-99 Contents in the HS Package
ETR 429 Filename: 06 Mo-99 Gas Generation v2-2	V2.2	Radiolytic Gas Formation in Mallinckrodt Produced Mo99 Solutions, Mallinckrodt Technical Report
CS 2017/02	B	Maximum Pressure in Containment Vessel 3978 Under NCT and HAC with I-131 Contents
<b>Section 4 - CONTAINMENT</b>		
Pages 4-1 to 4-11	Rev 14	
<b>Documents in Section 4.5.2, Appendix</b>		
CS 2012/04	Issue A	SAFKEG-HS 3977A - CV seal leak size for leaktight condition
CS 2012/05	Issue A	SAFKEG-HS 3977A - Gas contents limit for leaktight condition
CS2018/01	Issue A	SAFKEG-HS 3977A - Gas contents limit for leaktight condition - Thorium target
<b>Section 5 - SHIELDING EVALUATION</b>		



Page/Document Reference	Issue Status	Title
Pages 5-1 to 5-32	Rev 14	
<b>Documents in Section 5.5.2, Appendix</b>		
CTR2011/01	Issue D	SAFKEG HS 3977A: Package Activity Limits Based on Shielding
CTR2013/09	Issue C	Uncertainties Associated with the Proposed Shielding Calculation Method for the SAFKEG-HS 3977A Package
AMEC/SF6652/001	Issue 2	Monte Carlo Modelling of Safkeg HS Container
AMEC/CRM37327/TN_001	Issue 1	HS Container Shielding Assessment with I-131
AMEC/CRM37327/TN_001	Issue 1	HS Container Shielding Assessment with Mo-99
Atkins 5183326-HS-REP-001	01	Shielding Assessment of the 3977A SAFKEG Transport Package Type B(U) with Thorium Target Source
<b>Section 6 - CRITICALITY EVALUATION</b>		
Page 6-1	Rev 14	
<b>Documents in Section 6.9, Appendix</b>		
None	-	
<b>Section 7 - OPERATING PROCEDURES</b>		
Pages 7-1 to 7-16	Rev 14	
<b>Documents in Section 7.5, Appendix</b>		
None	-	
<b>Section 8- ACCEPTANCE TESTS AND MAINTENANCE PROGRAM</b>		
Pages 8-1 to 8-14	Rev 14	
<b>Documents in Section 8.3, Appendix</b>		

Page/Document Reference	Issue Status	Title
None	-	