COMPLETE

ENGINEERING CHANGE NOTICE

1. ECN 630861
Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	3a. USQ Required?	4. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	EP Clements/84300/G1-13/ 376-4446	[] Yes [X] No	07/15/96
	5. Project Title/No./Work Order No. GNS-12 PDC	6. Bldg./Sys./Fac. No. NA	7. Approval Designator SQD
	8. Document Numbers Changed by this ECN (includes sheet no. and rev.) WHC-SD-TP-PDC-033, Rev. 0	9. Related ECN No(s). NA	10. Related PO No. NA

11a. Modification Work	11b. Work Package No.	11c. Modification Work Complete	11d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 11b) [X] No (NA Blks. 11b, 11c, 11d)	NA	NA Cog. Engineer Signature & Date	NA Cog. Engineer Signature & Date

12. Description of Change

The following changes are made to the GNS-12 PDC:

1. Inadvertently left U.S. Department of Energy (DOE), and Safety and Environmental Advisory Council (SEAC) approvers off of original EDT 613314 which released the PDC for the GNS-12 Cask.
2. Change the GNS-12 from a Safety Evaluation for Packaging (SEP) to a Safety Analysis Report for Packaging (SARP).

13a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

13b. Justification Details

1. Due to Highway Route Controlled Quantities (HRCQ) being transported in the GNS-12 Cask, DOE and SEAC approvals are required.
2. Based on the original GNS-12 PDC, the U.S. Department of Energy, Richland Operations Office (RL) requested the SEP be changed to a SARP due to the lack of a defined storage location greater than five years. The SARP justification allows the cask and its contents the ability to be transported onsite if a suitable permanent storage location is identified.

14. Distribution (include name, MSIN, and no. of copies)

See attached.

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JUL 24 1996
DATE:
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ID: 20

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 630861

15. Design Verification Required
[ ] Yes
[X] No

16. Cost Impact

ENGINEERING			CONSTRUCTION		
Additional	[NA]	$	Additional	[NA]	$
Savings	[NA]	$	Savings	[NA]	$

17. Schedule Impact (days)
Improvement [NA]
Delay [NA]

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[ ]	Seismic/Stress Analysis	[ ]	Tank Calibration Manual	[ ]
Functional Design Criteria	[ ]	Stress/Design Report	[ ]	Health Physics Procedure	[ ]
Operating Specification	[ ]	Interface Control Drawing	[ ]	Spares Multiple Unit Listing	[ ]
Criticality Specification	[ ]	Calibration Procedure	[ ]	Test Procedures/Specification	[ ]
Conceptual Design Report	[ ]	Installation Procedure	[ ]	Component Index	[ ]
Equipment Spec.	[ ]	Maintenance Procedure	[ ]	ASME Coded Item	[ ]
Const. Spec.	[ ]	Engineering Procedure	[ ]	Human Factor Consideration	[ ]
Procurement Spec.	[ ]	Operating Instruction	[ ]	Computer Software	[ ]
Vendor Information	[ ]	Operating Procedure	[ ]	Electric Circuit Schedule	[ ]
OM Manual	[ ]	Operational Safety Requirement	[ ]	ICRS Procedure	[ ]
FSAR/SAR	[ ]	IEFD Drawing	[ ]	Process Control Manual/Plan	[ ]
Safety Equipment List	[ ]	Cell Arrangement Drawing	[ ]	Process Flow Chart	[ ]
Radiation Work Permit	[ ]	Essential Material Specification	[ ]	Purchase Requisition	[ ]
Environmental Impact Statement	[ ]	Fac. Proc. Samp. Schedule	[ ]	Tickler File	[ ]
Environmental Report	[ ]	Inspection Plan	[ ]	None	[X]
Environmental Permit	[ ]	Inventory Adjustment Request	[ ]		[ ]

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
NA		

20. Approvals

Signature	Date
OPERATIONS AND ENGINEERING	
Cog. Eng.: EP Clements	7/16/96
Cog. Mgr.: JG Field	7/16/96
QA: CR Hoover	7/17/96
Safety: DW McNally	7/17/96
Environ.	
Other	
EF Koehling for ETKoehling	7/19/96
SS Shiraga	7/16/96
RJ Smith	7/16/96
GL Swearingen	7/19/96

Signature	Date
ARCHITECT-ENGINEER	
PE	
QA	
Safety	
Design	
Environ.	
Other	
DEPARTMENT OF ENERGY	
Signature or a Control Number that tracks the Approval Signature	
DW Claussen	7/23/96
ADDITIONAL	
SEAC: WJ Schlauder	

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1) 630861

15. Design Verification Required	16. Cost Impact				17. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[ ] Yes	Additional	[NA] $	Additional	[NA] $	Improvement	[NA]
[X] No	Savings	[NA] $	Savings	[NA] $	Delay	[NA]

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OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog. Eng.: EP Clements	7/16/96	PE	
Cog. Mgr.: JG Field	7/16/96	QA	
QA: CR Hoover	7/17/96	Safety	
Safety: DW McNally	7/17/96	Design	
Environ.		Environ.	
Other		Other	
EF Koehling	7/19/96		
SS Shiraga	7/16/96		
RJ Smith	7/16/96	DEPARTMENT OF ENERGY	
GL Swearingen	7/19/96	Signature or a Control Number that tracks the Approval Signature	
		DW Claussen	
		ADDITIONAL	
		SEAC: WJ Schleuder	7/22/96

GNS-12 Packaging Design Criteria

E. P. Clements
Westinghouse Hanford Company, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: ECN 630861 UC: 512
Org Code: 84100 Charge Code: BE1224
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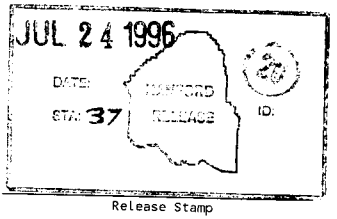
Key Words: GNS-12, Packaging Design Criteria, PDC, Safety Analysis Report for Packaging, SARP

Abstract: The purpose of this Packaging Design Criteria (PDC) is to provide criteria for the Safety Analysis Report for Packaging (SARP) (Onsite). The SARP provides the evaluation to demonstrate that the onsite transportation safety criteria are met for the transport and storage of the 324 Building vitrified encapsulated material in the GNS-12 cask. In this application, the approved PDC provides a formal set of standards for the payload requirements, and guidance for the current cask transport configuration and a revised storage seal and primary lid modification design.



Release Stamp

James Bishop 7-24-96
Release Approval Date

Approved for Public Release

RECORD OF REVISION	(1) Document Number WHC-SD-TP-PDC-033	Page 1

(2) Title
GNS-12 Packaging Design Criteria

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) EDT 613314 dated 03/01/96.		
1 RS	This revision changes the GNS-12 from a Safety Evaluation for Packaging (SEP) to a Safety Analysis Report for Packaging (SARP). Replace all pages. Per ECN 630861.	EP Clements	JG Field 7/14/96

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CONTENTS (cont)

LIST OF FIGURES

LIST OF TABLES

LIST OF TERMS

ALARA	As Low As Reasonably Achievable
Bq	Bequerels
CFR	Code of Federal Regulations
Ci	Curie
CWC	Central Waste Complex
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EDE	effective dose equivalent
FRG	Federal Republic of Germany
HRCQ	Highway Route Controlled Quantity
IAEA	International Atomic Energy Agency
mm	millimeters
mrem/h	millirem per hour
PDC	Packaging Design Criteria
Pacific Northwest	Pacific Northwest National Laboratory
PTB	German Federal Physical-Technical Institution, Braunschweig
QA	Quality Assurance
R/h	Roentgen per hour
RL	U.S. Department of Energy, Richland Operations Office
RQ	Reportable Quantity
SAR	Safety Analysis Report
SARP	Safety Analysis Report for Packaging
Sv/h	Sieverts per hour
WHC	Westinghouse Hanford Company

GNS-12 PACKAGING DESIGN CRITERIA

1.0 INTRODUCTION

1.1 BACKGROUND

Encapsulated vitrified materials (Isotopic Heat Sources) are currently stored in the Pacific Northwest National Laboratory (Pacific Northwest) 324 Building located in the 300 Area. As part of the 324 Building transition program, the vitrified material, encapsulated in (steel canisters), must be removed. The canisters will be transported onsite in the GNS-12 cask for interim storage until final disposition of the material is determined. The GNS-12 cask, designed and fabricated by GNS Gesellschaft für Nuklear-Service mbH, Essen, was a certified Type B(U) Packaging, which complies with the 1985 Safety Series No. 6 (IAEA 1990) requirements of the International Atomic Energy Agency (IAEA) for transport of sealed canisters of vitrified radioactive materials. The cask held a Competent Authority Certification [USA/0441/B(U), Rev. 0 (1991-1993), see Section 6.3] by the U.S. Department of Transportation (DOT) for the same material. The GNS-12 cask was originally designed to transport isotopic heat sources ($^{137}Cs/^{90}Sr$ borosilicate glass) encapsulated in steel canisters from the USA to the Federal Republic of Germany (FRG). The cask, which can accommodate up to three such canisters, is designed and fabricated as a composite type container with lead shielding in between outer and inner steel liners.

1.2 PURPOSE AND SCOPE

The purpose of this Packaging Design Criteria (PDC) is to provide criteria for the Safety Analysis Report for Packaging (SARP) (Onsite). The SARP provides the evaluation to demonstrate that the onsite transportation safety criteria are met for the transport and storage of the 324 Building vitrified encapsulated material in the GNS-12 cask. In this application, the approved PDC provides a formal set of standards for the payload requirements, and guidance for the current cask transport configuration and a revised storage seal and primary lid modification design.

The SARP will be approved by Pacific Northwest and the Westinghouse Hanford Company (WHC), including Quality Assurance (QA) and Safety, to authorize onsite interarea transfer. Due to the large quantities of radioactive materials being classified as Highway Route Controlled Quantity (HRCQ), the SARP will also require the approval of the U.S. Department of Energy (DOE), Richland Operations Office (RL).

1.3 JUSTIFICATION

Presently, there are 32 steel canisters being stored in the 324 Building. This material must be removed to allow for the 324 Building to be decommissioned. The cask that will be used for the campaign must:

1. Provide adequate shielding for operational personnel.

2. Maintain the encapsulated vitrified material in its original configuration during normal and accident transport conditions.

3. Effectively dissipate payload thermal heat loads.

4. Maintain the material in a nonreactive environment during storage.

5. Be compatible with the 324 Building facility and operation requirements.

6. Provide ease of operation for loading, unloading, transporting, maintaining, and storing.

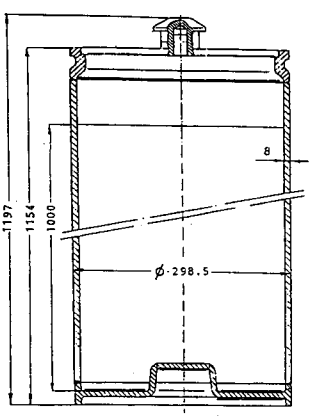
The packaging that best meets these requirements is the GNS-12 cask.

2.0 PACKAGE CONTENTS

2.1 PAYLOAD DESCRIPTION

The payload (Figure 1) for the GNS-12 packaging system will consist of borosilicate glass encapsulated in steel canisters (PNL-6790/UC-510). The borosilicate glass matrix constituents were immobilized to yield a product with a predetermined thermal decay heat and surface radiological dose rate. The canisters' radiochemical characteristics for thermal heat load range between 1330 and 2285 W each. Radiological gamma exposure rates on contact are between 112,000 R/h (1,120 Sv/h) to 310,000 R/h (3,100 Sv/h). For purposes of this PDC, 100 R/h is conservatively assumed to equal 1 Sv/h.

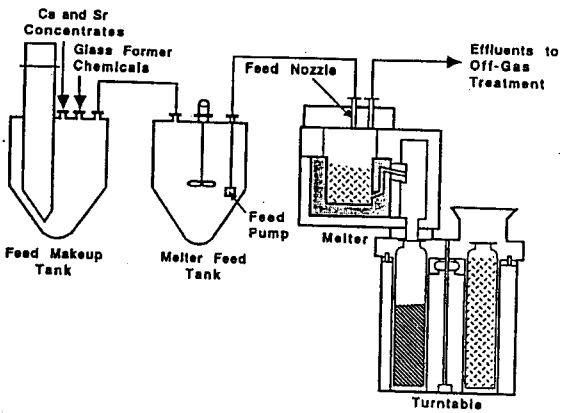
Figure 1. Heat Source (Canister) Payload Configuration.



2.2 RADIOACTIVE MATERIALS

The vitrified encapsulated material to be transported contains significant amounts of ^{137}Cs and ^{90}Sr. Three specific campaigns (RLFCM-7, RLFCM-8, and RLFCM-9) were performed by Pacific Northwest during heat source (canister) development. Figure 2 shows the canister filling process. Figure 3 provides graphs depicting the specific oxide in glass weight percent of all three canister campaigns.

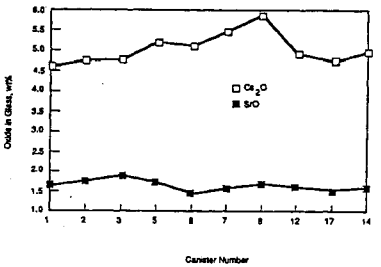
Figure 2. Canister Filling Process.



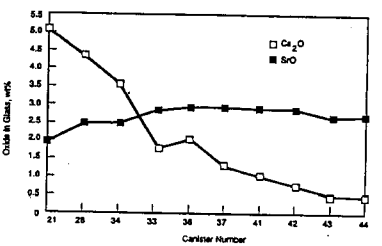
2.2.1 Source Term

The worst case canister inventory was taken from the Safety Analysis Report (SAR) for the CASTOR GSF cask (GNS 1990). The GNS-12 cask will contain the same type of material that the CASTOR GSF cask will contain; therefore, the source term information from the CASTOR GSF cask (GNS 1990) also applies to the GNS-12 cask. Table 1 lists the worst case canister activities from the CASTOR GSF SAR and the activities of their equilibrium daughter as calculated by ORIGEN. It also lists the maximum cask activities assuming a loading of three canisters per cask. Note also that the daughter products included in Table 1 contribute less than 1% to the total radiological dose.

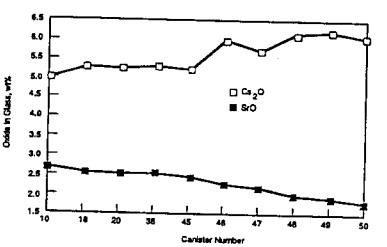
Figure 3. Canister Campaign Graphs.



RLFCM-7 Cesium and Strontium Concentrations



RLFCM-8 Cesium and Strontium Concentrations



RLFCM-9 Cesium and Strontium Concentrations

Table 1. GNS-12 Source Term.

Nuclide	Single Canister Activity, Ci	Maximum Cask Activity, Ci[a]	Nuclide	Single Canister Activity, Ci	Maximum Cask Activity, Ci[a]
^{90}Sr	2.1 E+05	6.3 E+05	^{234}Th	3.4 E-06	1.0 E-05
^{90}Y	2.1 E+05	6.3 E+05	^{234m}Pa	3.4 E-06	1.0 E-05
^{137}Cs	3.0 E+05	9.0 E+05	^{234}U	5.3 E-06	1.6 E-05
^{137m}Ba	2.8 E+05	8.4 E+05	^{235}U	1.9 E-07	5.7 E-07
^{208}Tl	1.2 E-04	3.6 E-04	^{236}U	4.4 E-07	1.3 E-06
^{212}Pb	3.3 E-04	9.9 E-04	^{237}U	5.5 E-05	1.7 E-04
^{212}Bi	3.3 E-04	9.9 E-04	^{238}U	3.4 E-06	1.0 E-05
^{212}Po	2.1 E-04	6.3 E-04	^{239}Np	2.0 E-01	6.0 E-01
^{216}Po	3.3 E-04	9.9 E-04	^{238}Pu	1.7 E-01	5.1 E-01
^{220}Rn	3.3 E-04	9.9 E-04	^{239}Pu	1.7 E-01	5.1 E-01
^{224}Ra	3.3 E-04	9.9 E-04	^{240}Pu	5.6 E-02	1.7 E-01
^{228}Ra	3.3 E-04	9.9 E-04	^{241}Pu	2.3 E+00	6.9 E+00
^{228}Ac	3.3 E-04	9.9 E-04	^{242}Pu	4.6 E-05	1.4 E-04
^{228}Th	3.3 E-04	9.9 E-04	^{241}Am	3.4 E-01	1.0 E+00
^{231}Th	1.9 E-07	5.7 E-07	^{242}Am	2.0 E-01	6.0 E-01
^{232}Th	3.3 E-04	9.9 E-04	TOTALS	1.0 E+06	3.0 E+06

a - Assumes a maximum of three canisters will be loaded in the GNS-12 cask.

2.3 CHEMICAL CONSTITUENT SOURCE TERM

The SARP will evaluate how the vitrified encapsulated material will perform during and after accident events. The packaging system and administrative controls set forth in the SARP ensure the vitrified material configuration matrix is maintained. Table 2 gives the nominal glass compositions for all three canister productions.

Table 2. Nominal Glass Chemical Composition.

Oxide Compound	Average Glass Composition RLFCM-7, wt%	Average Glass Composition RLFCM-8, wt%	Average Glass Composition RLFCM-9, wt%
Al_2O_3	2.88	2.58	2.17
B_2O_3	13.68	14.65	14.84
BaO	1.05	1.13	1.02
CaO	1.52	1.25	0.79
CeO_2	0.06	0.05	0.07
Cr_2O_3	0.58	0.38	0.45
Cs_2O	5.02	2.08	5.74
Fe_2O_3	11.18	10.10	9.93
La_2O_3	1.04	1.07	1.53
Li_2O	0.31	0.00	0.00
MgO	0.78	0.54	0.44
MnO_2	0.80	1.20	1.11
MoO_3	0.05	0.00	0.00
Na_2O	16.50	13.22	11.58
Nd_2O_3	0.65	0.71	0.89
NiO	0.39	0.25	0.44
PbO	0.16	0.00	0.00
RuO_2	0.02	0.00	0.00
SiO_2	41.25	48.02	46.59
SrO	1.65	2.67	2.34
TiO_2	0.19	0.07	0.03
ZnO	0.08	0.01	0.00
ZrO_2	0.15	0.04	0.05
	100.00	100.00	100.00

2.4 GAS GENERATION

Based upon the glass form of the radioactive material and the containment provided by the canisters, there will be no gas generation.

2.5 TRANSPORTATION CLASSIFICATION

For transportation purposes, the vitrified encapsulated material of this packaging is considered Type B, Reportable Quantities (RQ), HRCQ, Yellow III, Radioactive Material in accordance with the *Hazardous Material Packaging and Shipping*, WHC-CM-2-14.

2.6 FISSILE CLASSIFICATION

There is less than 15 g of fissile material; therefore, the payload shall be classified as fissile excepted for transportation.

2.7 CONTENT RESTRICTIONS

A single GNS-12 cask may contain up to a maximum of three steel GNF/GSF canisters. Each canister can contain a maximum activity of 297.0 kCi (1.1×10^{16} Bq) ^{137}Cs and 207.9 kCi (7.7×10^{15} Bq) $^{90}Sr/^{90}Y$, respectively. The maximum thermal wattage of each canister is 2285 W. The maximum weight of the payload without the basket (three canisters loaded) is 1650 lb (750 kg).

3.0 FACILITY OPERATIONS

3.1 ORIGINATING SITE - 324 BUILDING

The vitrified material will be loaded in the GNS-12 cask. All cask loading shall take place in the 324 Hot Cells. The casks will be loaded onto the transport vehicle in the configuration of the open-all closed transport system.

3.2 DESTINATION SITE - 200 WEST AREA

The current storage site of the loaded GNS-12 cask has not been determined at this time. The SARP will identify this location and applicable requirements. The cask transport system can be unloaded from the transport vehicle if required and placed in the appropriate storage site.

4.0 PACKAGING/TRANSPORT SYSTEM DESIGN

4.1 GENERAL

The GNS-12 cask consists of a welded stainless steel and lead composite structure. The cask body and closure lid and seals form the containment system ensuring the integrity of the package. A basket is inserted in the cavity of the cask in order to secure the contents. The cask is handled with the aid of lifting trunnions. In order to reduce the load during transport accidents, impact limiters are mounted over the ends of the cask.

The GNS-12 cask will be modified for the onsite transport and storage of vitrified encapsulated material. The modification will consist of replacing one of the double elastomeric containment seals in the primary lid with a metallic seal. This SARP will evaluate and certify all three transport configurations (double elastomer, WHC design, and German lid modification). No other design changes are planned.

4.2 PACKAGING DESIGN CRITERIA

4.2.1 Packaging Specification and Materials

4.2.1.1 GNS-12 Cask. The GNS-12 cask (Figure 4) structural design covers all safety related parts of the packaging in compliance with the requirements for transport. This includes analysis of all considered loads, stresses, and safety factors which are essential to meet the transportation standards for a Type B packaging under normal operations and hypothetical accident conditions. The GNS-12 cask structural design is based on a 30 ft (9 m) drop criteria.

The cask is designed for a *g*-loading of 220*g* for an end drop. The GNS-12 cask incorporates five basic components which maintain the structural integrity and safe confinement of its payload.

The five basic components are:

1. Impact limiters, which protect the ends of the outer cask during transport.
2. Outer shell (secondary containment).
3. Inner liner (primary containment).
4. Lid and seal systems (primary lid, double seals).
5. Basket to keep the payload in position (canisters).

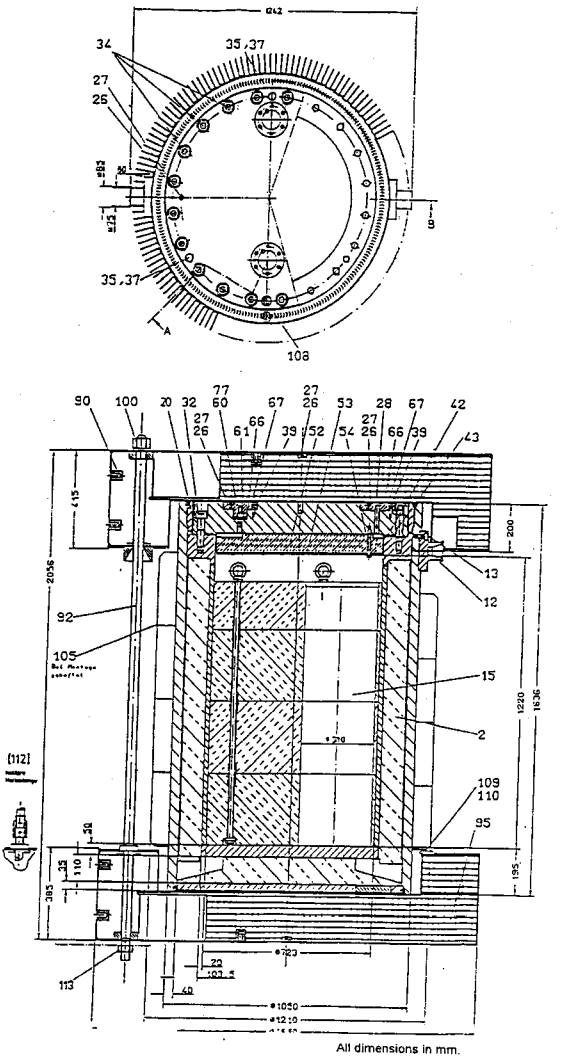
4.2.2 Packaging Dimensions

Table 3 provides the nominal dimensions of the GNS-12 cask.

Table 3. GNS-12 Cask Dimensions.

Description	Dimensions	
	in.	cm
Overall height with lid	64.4	163.6
Outside width (with impact limiters)	65.0	165.0
Outside length (with impact limiters)	81.0	205.6
Container body height (with lid)	64.4	163.6
Inner cavity height (with lid)	48.0	122.0
Inner cavity diameter	28.5	72.3
Inner cavity length (without lid)	57.0	144.0
Lead shielding thickness (lid)	3.0	8.0
Lead shielding thickness (body)	4.0	10.0

Figure 4. Assembled Cask(s) and Primary Lid Configuration.



4.2.3 Maximum Gross Weight

The empty weight of the GNS-12 cask with basket is 25,945 lb (11,766 kg). The complete assembled cask (loaded) is 27,600 lb (12,500 kg). The SARP shall confirm the maximum allowable payload weight.

4.2.4 Tiedown Attachments

Currently, the cask has an engineered securement system for transport. This system incorporates the use of a closed transport container configuration (Figure 5). The SARP will evaluate the current engineered system as designed for meeting reasonable onsite transportation.

Tiedown or other attachments which are a structural part of the cask and used to secure the GNS-12 cask must have the capacity to withstand, without generating stress in any material of the GNS-12 cask in excess of yield strength, a static force applied to the center of gravity of the GNS-12 cask. The static force must have a vertical component of two times the gross weight of the fully loaded GNS-12 cask, a horizontal component along the direction in which the vehicle travels of ten times the weight of the fully loaded cask, and a horizontal component in the transverse direction of five times the weight of the fully loaded cask.

Any other structural part of the GNS-12 cask which could be used for securement must be capable of being rendered inoperable for securing the GNS-12 cask during transfer, or must have the strength equivalent required for the tiedown attachments to be used for such transfer applications.

Each tiedown attachment, which is a structural part of the GNS-12 cask, must be designed so that failure of the attachment under excessive load would not impair the ability of the GNS-12 cask to meet other requirements of this PDC.

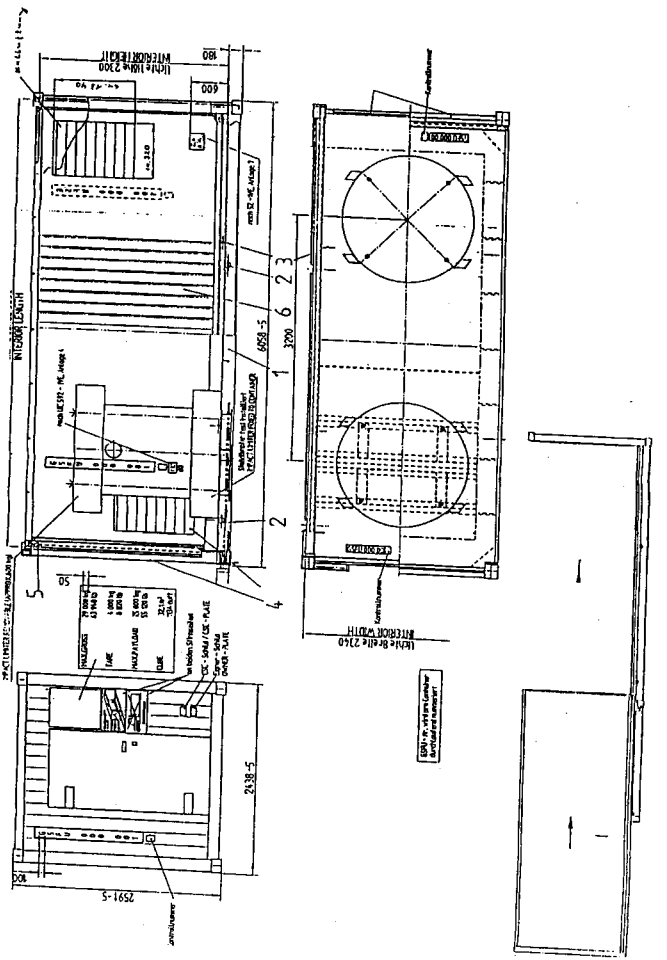
4.2.5 Lifting Attachments

The lifting attachments for the packaging shall be capable of lifting three times the total suspended weight without generating a combined stress or maximum tensile stress at any point in the load path in excess of the corresponding minimum yield strength of their materials of construction.

4.2.6 Venting

As presently designed, the cask does not vent to the surrounding atmosphere once the primary lid is installed and secured. The GNS-12 cask design incorporates a cavity drain, vacuum drying, and backfilling capability of the cask cavity with helium. This design eliminates the possibility of a hydrogen buildup in the cask cavity during transport and/or storage due to dry loading, and vacuum drying and testing. With respect to activity releases, the payload canister is considered part of the containment system.

Figure 5. Twenty Foot Open All Closed Transport Container.

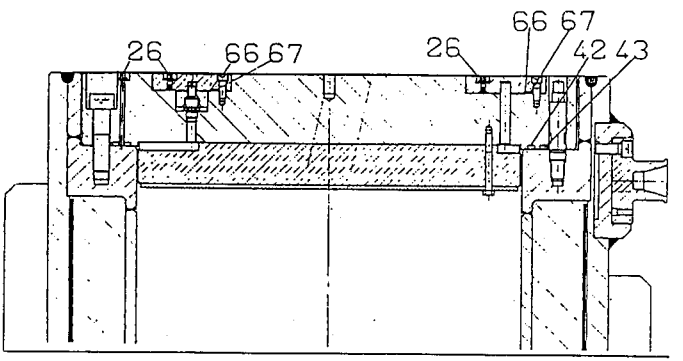


All dimensions in mm.

4.2.7 Closure Design and Containment

Positive closure of the GNS-12 cask is currently achieved through bolting the primary lid to the cask body with 20 cap screws, size M 30. Currently in the seal surfaces of the lid, there are two concentric groves to accommodate elastomer seals. The SARP will evaluate the use of WHC and German metallic seal (Helicoflex[1]) designs for the cask primary lid inner concentric grooves to meet transport requirements. The elastomeric seals can be of Viton[2] type for the primary lid outer concentric groove (transportation seal, Figure 6, Numbers 43 and 67). With these, a test volume is defined in the GNS-12 SARP for the leak-tightness test $< 1.0 \times 10^{-3}$ atm cc/s, air ($< 1.0 \times 10^{-3}$ mbar L/s). The most significant sealing action for storage is produced by the inner elastomeric or metallic seal (Figure 6, Numbers 26, 42, and 66). The SARP will evaluate all three configurations and define any additional design features required to meet Section 4.1 and the acceptance criteria of Section 5.0 defined in this PDC.

Figure 6. Primary Lid Sealing System.



The SARP will evaluate upgrades to the current cask sealing configuration. This evaluation and analysis (where applicable) will determine and authorize the existing seal design and upgrades to the cask primary lid sealing system. The upgrades to the primary lid sealing system allows the combination use of metallic and elastomeric seal configurations for the loaded cask to meet transportation and interim storage requirements. The primary lid seal upgrades shall meet the conditions of Section 5.1, and the acceptance criteria specified in Sections 5.1.1 and 5.1.2 defined in this PDC.

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[1] Helicoflex is a trademark of the Helicoflex Corporation.

[2] Viton is a trademark of the E. I. duPont de Nemours and Company.

4.2.8 Shielding

The GNS-12 cask shielding is designed such that the package general surface dose rate is no greater than a maximum of 200 mR/h and 10 mR/h or less at 1 m (3.3 ft) from the package.

4.2.9 Service Life

For transportation, the assumed cask lifetime is forty years and twenty transports per year as defined in the GNS-12 SARP.

4.2.10 Chemical and Galvanic Reactions

The payload of the GNS-12 cask will be limited so reactions (e.g., chemical or galvanic reactions) among the components and the cask are minimized.

4.2.11 Surface Contamination

Before transfer, contamination on the external surfaces of the GNS-12 cask shall not exceed the limits given in Table 4.

Table 4. Decontamination Limits.

Contaminant	Maximum Permissible Limits	
	$\mu Ci/cm^2$	dpm/cm^2
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than ten days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates	10^{-5}	22
All other alpha emitting radionuclides	10^{-6}	2.2

Table from 49 CFR 173.443.

4.3 TRANSPORT SYSTEM

4.3.1 Transport Vehicle

The GNS-12 cask shall be transported by tractor-trailer or by rail as a closed transport vehicle. The SARP will document the requirements of the transport configurations and any modifications that must be performed to allow for the safe onsite interarea transfer of the cask.

4.3.2 Tiedowns

The existing GNS-12 cask securement/tiedown system (Figure 5), as described in Section 4.2.4, will be evaluated for meeting reasonable onsite transportation.

5.0 GENERAL REQUIREMENTS

5.1 TRANSPORTATION EVALUATION REQUIREMENTS

The SARP shall evaluate the packaging requirements for the transport of Type B radioactive material as defined by IAEA Safety Series No. 6 (IAEA 1990). Evaluations will be included to address the ability of the altered packaging system to provide containment, shielding, adequate thermal heat dispersal, and a subcritical environment for the vitrified encapsulated material under normal and accident conditions of transport on the Hanford Site. The analyses address the new WHC metallic seal design and German lid modifications. All analyses are based on the original GNS-12 SARP.

5.1.1 Normal Transfer Conditions

The existing GNS-12 cask design meets IAEA Safety Series No. 6 for normal conditions of transport and has the capacity to retain the payload, limit direct radiation, adequately dissipates thermal heat from the payload, and maintain subcriticality during normal transfer conditions. Design changes described in this PDC shall not change cask performance capabilities as specified in the GNS-12 SARP.

a. **Containment.** The GNS-12 cask shall prevent the loss or dispersal of the radioactive contents during normal transfer conditions. The payload canister is considered part of the containment system. Containment of the GNS-12 cask shall be maintained to $10^{-6}/A_2$ per hour during normal conditions of transport.

b. **Shielding.** Contents of the GNS-12 cask shall be transported as a full load (exclusive use). Therefore, the shielding design limits of the GNS-12 cask as designed will limit the average accessible contact dose rate to 200 mrem/h (0.002 Sv/h). The dose rate at 6.6 ft (2 m) from the cask surface shall be limited to 10 mrem/h (0.0001 Sv/h). The dose rate at any normally occupied space in the transfer vehicle shall be limited to less than 2 mrem/h (0.00002 Sv/h). Transport of the casks shall fall under HRCQ exclusive use.

c. **Criticality.** The amount of fissile material within the GNS-12 cask payload (radioactive nuclides - three canisters) is less than 8.5 g. Consequently, subcriticality is maintained for any arrangement of the cask which fall under fissile excepted quantity.

5.1.2 Accident Events

a. **Containment.** The GNS-12 cask shall maintain containment to an A_2 per week for accident conditions.

b. **Shielding.** The contents of the packaging shall be limited such that the external dose rate shall not exceed 1 rem/h (0.01 Sv/h) at 3.3 ft (1 m) from the surface of the cask.

5.1.3 Thermal

The SARP shall verify the maximum thermal payload currently described in the GNS-12 SARP that may be transported in the cask. The maximum thermal heat load shall be limited to ensure the integrity of the cask during normal conditions of transport is not compromised. Additionally, thermal heat dissipation from the cask payload shall be limited so that the maximum exterior temperature of the cask will be less than 180 °F (82 °C) during the hottest Hanford Site day without considering solar insolation. If required, the SARP will also limit the climatic conditions under which the cask may be transported. Based on the current GNS-12 SARP, gas generation is not a concern.

5.2 AS LOW AS REASONABLY ACHIEVABLE

The design features of the GNS-12 cask meet IAEA Safety Series No. 6, and shall be consistent with 10 CFR 71 hypothetical accident conditions for transport and the requirements of the *ALARA Program Manual*, WHC-CM-4-11. Exposure of personnel to radiological and other hazardous materials associated with the loading, closure, tiedown, transfer, and off-loading of the package shall be minimized.

5.3 QUALITY ASSURANCE

Quality Assurance (QA) program requirements for activities such as design, procurement, fabrication, inspection, testing, component handling, and documentation of the GNS-12 cask and their components are specified in the GNS-12 Cask SARP (GNS 1989).

To establish a QA plan for the GNS-12 cask, a graded approach is used to define the safety class of both the system and individual components of the packaging system. The application of the safety class system is fully documented in the *Quality Assurance Manual*, WHC-CM-4-2. QA instructions or plans shall be developed for the procurement, fabrication, and inspection of the package based on the assigned safety class of the package. The *QA Program Plan for the Hazardous Materials Transportation and Packaging Program*, WHC-IP-0705 (WHC 1995), and *Nonreactor Facilities Safety Analysis Manual*, WHC-CM-4-46, defines the WHC QA and safety class implementation, respectively, for radioactive material shipping packages.

5.3.1 System Safety Class

The transportation safety class of the GNS-12 cask was determined by a transportation safety class evaluation included in Section 6.2. This evaluation assumed the total failure of the packaging system and the release of all of its contents to the environment at the worst possible location on the transportation route. For the shipment of the 324 Building vitrified material, the worst case release location is within the 300 Area, 330 ft (100 m) from the release point.

The safety class evaluation guidelines contained in WHC-CM-4-46, Section 9.0, were followed. A worst case event is postulated which results in

a dose to the maximum onsite and offsite receptor of 13 rem (1.3×10^{-1} Sv). The onsite and offsite doses are the same because several 300 Area locations have roads which are accessible to the public. The onsite and offsite receptor locations are therefore both assumed to be 100 m from the release point. Since the maximum offsite dose is greater than 0.5 rem, the required Safety Class for the GNS-12 cask is Safety Class 1.

5.4 DESIGN FORMAT

Development of the design drawings, design changes, and other design documentation, if required, shall be in accordance with the *Standard Engineering Practices*, WHC-CM-6-1, and the *Drafting Standards* manual, WHC-CM-6-3.

5.5 ENVIRONMENTAL COMPLIANCE

Actions and conditions for the protection of the environment during transfer of the GNS-12 cask shall comply with the requirements of the *Environmental Compliance* manual, WHC-CM-7-5.

5.6 MAINTENANCE

The maintenance schedule for the cask shall be in accordance with As Low As Reasonably Achievable (ALARA) principles and its original SARP GNS B 50/87, Rev. 5 (GNS 1989).

5.7 REUSE

The SARP will define guidelines on inspection and maintenance that will allow the cask to be reused in accordance with WHC-CM-2-14 and the original SARP.

6.0 APPENDICES

6.1 REFERENCES

BAM, 1987, Testing of a Type B(U) Package of Type "GNS 12 Shipping Cask," File Number 1.5/22141, Copy Number 2, German Federal Materials Testing Institute (BAM) Test Certificate, November 5, 1987.

GNS, 1989, *Safety Analysis Report for the GNS-12 Shipping Cask*, GNS B 50/87, Rev. 5, Gesellschaft für Nuklear-Service mbH, Essen., Federal Republic of Germany, October 1989.

GNS, 1990, *Safety Analysis Report CASTOR GSF*, GNS B 69/85, Rev. 10, Gesellschaft für Nuklear-Service mbH, Essen., Federal Republic of Germany, July 1990.

IAEA, 1990, *Regulations for the Safe Transport of Radioactive Material 1985 Edition*, IAEA Safety Series No. 6, as amended 1990, International Atomic Energy Agency, Vienna, Austria.

NRC, 1984, *NRC IE Information Notice 84-72*, U.S. Nuclear Regulatory Commission, Washington, D.C., September 10, 1984.

PTB, 1990, Certificate Of Approval for the GNS-12 Shipping Cask, German Federal Physical-Technical Institution (PTB), Braunschweig D/2065/B(U) Rev. 2, February 7, 1990.

RL, 1994, *Hanford Site Radiological Control Manual*, HSRCM-1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

WHC-CM-2-14, *Hazardous Material Packaging and Shipping*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-2, *Quality Assurance Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-11, *ALARA Program Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-6-1, *Standard Engineering Practices*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-6-3, *Drafting Standards*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance*, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *Hanford Solid Waste Acceptance Criteria*, WHC-EP-0063, Westinghouse Hanford Company, Richland, Washington.

WHC, 1995, *QA Program for the Hazardous Materials Transportation and Packaging Program*, WHC-IP-0705, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

6.2 SAFETY CLASS EVALUATION

ENGINEERING ANALYSIS

Subject TRANSPORTATION SAFETY CLASS EVALUATION FOR GNS-12 CASK
Revision 0 Project Title GNS-12 CASK WO BE1223
Originator A. V. Savino (pages 1-12) Date 12/27/95
Checker J R Green (1-12) Date 1/2/96

I. Objectives:

This engineering analysis documents a transportation safety class evaluation for the GNS-12 Cask which will be used to transport canisters containing activated vitrified glass material from the 324 Building in the 300 Area to the 200 West Area.

II. References:

60 FR 50319, 1995, "Hazardous Materials, Transportation Regulations; Compatibility With Regulations of the International Atomic Energy Agency (IAEA); Final Rule," 49 CFR Part 171, *Federal Register*, Vol. 60, No. 188, pp. 50319-50325.

DOE, 1994, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, DOE-HDBK-3010-94, U. S. Department of Energy, Washington, D. C.

Hey, B. E., 1995a, *GXQ 4.0 Program Users' Guide*, WHC-SD-GN-SWD-30002, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Hey, B. E., 1995b, *GXQ 4.0 Program Verification and Validation*, WHC-SD-GN-SWD-30003, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

Napier, B. A., et al., December 1988, *GENII - The Hanford Environmental Radiation Dosimetry Software System*, Pacific Northwest Laboratory, Richland, Washington, PNL-6584 Vol. 1, UC-600.

NRC, 1982, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Regulatory Guide 1.145, U.S. Nuclear Regulatory Commission, Washington, D.C.

Schmittroth, 1993, *Conversion of ORIGEN2 to Sun Workstations*, WHC-SD-NR-SWD-006 Rev. 0-A, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Westinghouse Hanford Company, Richland, Washington.

III. Results and Conclusions:

The safety class evaluation guidelines contained in WHC-CM-4-46, Section 9, were followed. A worst case event is postulated which results in a dose to the maximum onsite and offsite receptor of 13 rem (1.3×10^{-1} Sv). The onsite

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and offsite doses are the same because several 300 Area locations have roads which are accessible to the public. The onsite and offsite receptor locations are therefore both assumed to be 100 m from the release point. Since the maximum offsite dose is greater than 0.5 rem, the required transportation safety class for the GNS-12 cask is transportation safety class 1.

IV. Engineering Evaluation:

1.0 Introduction

The GNS-12 cask is designed to hold three activated glass canisters. A glass canister is a container with vitrified radioactive materials manufactured at Hanford. These casks will be transported from the 300 Area to the 200 West Area. An evaluation is necessary to determine the required transportation safety class for the cask.

2.0 Source Term

Table 1 lists the source term for the GNS-12 cask which was developed in Section 2 of the PDC.

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Table 1 - GNS-12 Source Term

Nuclide	Single Canister Activity, Ci	Maximum Cask Activity, Ci[a]
SR90	2.1E+05	6.3E+05
Y90	2.1E+05	6.3E+05
CS137	3.0E+05	9.0E+05
BA137m	2.8E+05	8.4E+05
TL208	1.2E-04	3.6E-04
PB212	3.3E-04	9.9E-04
BI212	3.3E-04	9.9E-04
PO212	2.1E-04	6.3E-04
PO216	3.3E-04	9.9E-04
RN220	3.3E-04	9.9E-04
RA224	3.3E-04	9.9E-04
RA228	3.3E-04	9.9E-04
AC228	3.3E-04	9.9E-04
TH228	3.3E-04	9.9E-04
TH231	1.9E-07	5.7E-07
TH232	3.3E-04	9.9E-04
TH234	3.4E-06	1.0E-05
PA234m	3.4E-06	1.0E-05
U234	5.3E-06	1.6E-05
U235	1.9E-07	5.7E-07
U236	4.4E-07	1.3E-06
U237	5.5E-05	1.7E-04
U238	3.4E-06	1.0E-05
NP239	2.0E-01	6.0E-01
PU238	1.7E-01	5.1E-01
PU239	1.7E-01	5.1E-01
PU240	5.6E-02	1.7E-01
PU241	2.3E+00	6.9E+00
PU242	4.6E-05	1.4E-04
AM241	3.4E-01	1.0E+00
AM243	2.0E-01	6.0E-01
TOTALS	1.0E+06	3.0E+06

[a] Assumes a maximum of 3 canisters will be loaded in the GNS-12 cask.

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3.0 Analysis

The safety class evaluation guidelines contained in WHC-CM-4-46, Section 9, were followed. A worst case airborne release fraction was determined based on a review of the potential accident scenarios which the package may experience.

The ARF and RF were calculated using a formula contained in DOE (1994), *Free-Fall Spill and Impaction Stress for Nonmetallic or Composite Solids*. This formula is associated with "fragmentation of an aggregate solid that can undergo brittle fraction." It is assumed for this analysis that an event occurs where the package is breached by an external force causing the vitrified material to be released and impact the ground. This impact causes fragmentation of the material at risk and subsequent release to the environment. The formula given is as follows:

$$ARF \times RF = (A)(P)(g)(h)$$

where:

ARF x RF = (Airborne Release Fraction)(Respirable Fraction)
A = empirical correlation, 2×10^{-11} cm^3 per $g\text{-}cm^2/s^2$
P = specimen density, g/cm^3
g = gravitational acceleration, 980 cm/s^2 at sea level
h = fall height, cm.

A fall height of 1 m is assumed for this analysis. This is a typical height used for objects falling off of a truck. The density of the waste is 2.8 g/cc, which results in an ARF x RF of 5.5×10^{-5}. This ARF x RF is applied to the material at risk, which is conservatively assumed to be the entire cask inventory, to obtain the quantity of radioactive material that is made airborne for the postulated accident scenario. The accident release quantities are listed in Table 2.

A fire scenario was also considered, but based on information contained in DOE (1994), *Thermal Stress - Vitrified Waste (Section 4.3.1.1)*, "any release under industrial-type fire conditions appears to be negligible." Therefore, no airborne release fire scenario is included in this analysis.

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Table 2 - Accident Release Quantities

Nuclide	Maximum Cask Activity, Ci[a]	Accident Release Quantity, Ci[b]
SR90	6.3E+05	3.5E+00
Y90	6.3E+05	3.5E+00
CS137	9.0E+05	5.0E+00
BA137m	8.4E+05	4.6E+00
TL208	3.6E-04	2.0E-09
PB212	9.9E-04	5.4E-09
BI212	9.9E-04	5.4E-09
PO212	6.3E-04	3.5E-09
PO216	9.9E-04	5.4E-09
RN220	9.9E-04	5.4E-09
RA224	9.9E-04	5.4E-09
RA228	9.9E-04	5.4E-09
AC228	9.9E-04	5.4E-09
TH228	9.9E-04	5.4E-09
TH231	5.7E-07	3.1E-12
TH232	9.9E-04	5.4E-09
TH234	1.0E-05	5.5E-11
PA234m	1.0E-05	5.5E-11
U234	1.6E-05	8.8E-11
U235	5.7E-07	3.1E-12
U236	1.3E-06	7.2E-12
U237	1.7E-04	9.4E-10
U238	1.0E-05	5.5E-11
NP239	6.0E-01	3.3E-06
PU238	5.1E-01	2.8E-06
PU239	5.1E-01	2.8E-06
PU240	1.7E-01	9.4E-07
PU241	6.9E+00	3.8E-05
PU242	1.4E-04	7.7E-10
AM241	1.0E+00	5.5E-06
AM243	6.0E-01	3.3E-06
TOTALS	3.0E+06	1.7E+01

[a] Assumes a maximum of 3 canisters will be loaded in the GNS-12 cask.

[b] Calculated using the maximum cask activities from column 1 and applying the ARF x RF value of 5.5×10^{-6} to all radionuclides.

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Discussion of Atmospheric Relative Concentration Value (χ/Q')

After the radioactive material becomes airborne, it is transported downwind and inhaled by onsite workers or the public. The concentration of this material is reduced, or diluted, as it is being transported due to atmospheric mixing and turbulence. An atmospheric relative concentration value (χ/Q') is used to characterize the dilution of the airborne contaminants during atmospheric transport and dispersion. It is equal to the time-integrated normalized air concentration at the receptor. χ/Q' (s/m^3) represents the dilution of an airborne contaminant caused by atmospheric mixing and turbulence. χ/Q' is a function of the atmospheric conditions (i.e., wind speed, stability class) and the distance to the receptor.

Bounding χ/Q' values are generated consistent with the methods described in *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*, Regulatory Guide 1.145 (NRC 1982). Since atmospheric conditions fluctuate, a bounding atmospheric condition is determined to be that condition that causes a downwind concentration of airborne contaminants that is exceeded only a small fraction of time because of weather fluctuations. Regulatory Guide 1.145 defines this fraction of exceedance as 0.5% for each sector or 5% for the overall Hanford Site. The Hanford Site is broken up into 16 sectors that represent 16 compass directions (i.e., S, SSW, SW, ..., ESE, SE, SSE). χ/Q' values are generated for weather conditions that result in downwind concentrations exceeded only 0.5% of the time in the maximum sector or 5% of the time for the overall Site. These χ/Q' values are also referred to as 99.5% maximum sector and 95% overall Site χ/Q' values. The greater of these two values is called the bounding χ/Q' value and is used to assess the dose consequences for accident scenarios. The bounding χ/Q' value represents minimum dispersing conditions that result in maximum downwind concentrations (i.e., concentrations exceeded only a very small fraction of the time). This χ/Q' value will therefore result in very conservative estimates of accident consequences.

The χ/Q' values in this report were generated using the GXQ computer program, Version 4 (Hey 1995a, 1995b). The meteorological data used by GXQ are in the form of joint frequency tables. The joint frequency data are the most recent data available; they are nine-year averaged data (1983-1991) from the Hanford Site meteorology towers. As mentioned above, the χ/Q' values are generated using the methods described in Regulatory Guide 1.145 for a ground release with no credit taken for plume rise, plume meander, plume depletion, or any other models. This is conservative because all of these models reduce the airborne concentration at the downwind receptor locations.

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The GNS-12 packages will be transported from the 300 Area to the 200 Area. Therefore, χ/Q' values for the maximum onsite receptor (assumed to be located 100 m from the release point) were calculated using the joint frequency data for these two areas (i.e., 200, 300 Areas), and the highest value was selected. The highest χ/Q' value of 4.2×10^{-2} s/m^3 occurs for the 300 Area.

The worst case offsite receptor (i.e., highest χ/Q') will be located in the 300 Area due to the short distances between the potential transport routes and an offsite receptor. Several 300 Area locations have roads which are accessible to the public. It is conservatively assumed for this analysis that the offsite receptor is located 100 m from the release point in any compass direction. The maximum onsite and offsite receptor χ/Q' value will therefore be the same, and since the highest χ/Q' occurs for the 300 area, the maximum offsite χ/Q' value is 4.2×10^{-2} s/m^3. The titles of the joint frequency files used by GXQ are listed below.

200 AREA (HMS) - 10 M - Pasquill A - G (1983 - 1991 Average)
300 AREA - 10 M - Pasquill A - G (1983 - 1991 Average)

Inhalation & Submersion Dose Calculations

The GENII computer code Version 1.485 (Napier 1988) was used to calculate the inhalation and submersion dose for the maximum onsite and offsite receptors using the χ/Q' value mentioned in the previous paragraph. The GENII input deck is listed in Attachment 1. The "Worst Case" solubility class library in GENII was selected since the form of the radioactive material is not known with a high degree of certainty. This solubility class is the most conservative library used in GENII. The GENII libraries used were as follows:

GENII Default Parameter Values (28-Mar-90 RAP)
Radionuclide Library - Times<100 years (23-July-93 PDR)
External Dose Factors for GENII in person Sv/yr per Bq/n (8-May-90
Worst-Case Solubilities, Yearly Dose Increments (23-Jul-93 PDR)

The Effective Dose Equivalent (EDE) for the inhalation and submersion pathways is 13 rem (1.3×10^{-1} Sv) for the maximum onsite and offsite receptors at 100 m. The inhalation dose contribution to the EDE is based on a 50 year dose commitment period. Table 3 summarizes the results. Note that $^{90}Sr/^{90}Y$ contribute 82% to the total dose, and ^{137}Cs contributes 17% to the total dose.

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Checker FRA Date 1/10/96

Table 3: Summary of Inhalation and Submersion Dose, rem		
	Maximum Onsite Receptor at 100 m	Maximum Offsite Receptor at 100 m
Whole Body EDE	13	13

Note: 100 rem = 1 Sv

4.0 Conclusion

The maximum offsite dose of 13 rem (1.3×10^{-1} Sv) is greater than 0.5 rem. Therefore, the required transportation safety class for the GNS-12 cask is transportation safety class 1.

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Attachment 1

GENII INPUT FILE

```
########################## Program GENII Input File ############ 8 Jul 88 ####
Title: Onsite at 100 m -  Inhalation/Submersion - GNS-12 - 300 Area
       \SAMPL\G-AIR.AC                          Created on 01-22-1990 at 07:30
OPTIONS======================== Default ================================
F    Near-field scenario?        (Far-field)    NEAR-FIELD: narrowly-focused
F    Population dose?            (Individual)               release, single site
T    Acute release?              (Chronic)      FAR-FIELD:  wide-scale release,
     Maximum Individual data set used                       multiple sites
                                 Complete                               Complete
TRANSPORT OPTIONS============ Section   EXPOSURE PATHWAY OPTIONS===== Section
T  Air Transport                   1     F  Finite plume, external        5
F  Surface Water Transport         2     T  Infinite plume, external      5
F  Biotic Transport (near-field)  3,4    F  Ground, external              5
F  Waste Form Degradation (near)  3,4    F  Recreation, external          5
                                         T  Inhalation uptake             5,6
REPORT OPTIONS======================     F  Drinking water ingestion      7,8
T  Report AEDE only                      F  Aquatic foods ingestion       7,8
F  Report by radionuclide                F  Terrestrial foods ingestion   7,9
F  Report by exposure pathway            F  Animal product ingestion      7,10
F  Debug report on screen                F  Inadvertent soil ingestion

INVENTORY ###########################################################

4   Inventory input activity units: (1-pCi  2-uCi  3-mCi  4-Ci  5-Bq)
0   Surface soil source units (1- m2  2- m3  3- kg)
    Equilibrium question goes here
```

Release Radionuclide	Use when transport selected: Air /yr	Surface Water /yr	Buried Waste /m3	Basic Concentrations near-field scenario, optionally: Air /m3	Surface Soil /unit	Deep Soil /m3	Ground Water /L	Surface Water /L
SR90	3.5E+00							
Y 90	3.5E+00							
CS137	5.0E+00							
PB212	5.4E-09							
BI212	5.4E-09							
RA224	5.4E-09							
RA228	5.4E-09							
AC228	5.4E-09							
TH228	5.4E-09							
TH231	3.1E-12							
TH232	5.4E-09							
TH234	5.5E-11							
U 234	8.8E-11							
U 235	3.1E-12							
U 236	7.2E-12							
U 237	9.4E-10							
U 238	5.5E-11							
NP239	3.3E-06							
PU238	2.8E-06							
PU239	2.8E-06							
PU240	9.4E-07							
PU241	3.8E-05							

ENGINEERING ANALYSIS

Subject TRANSPORTATION SAFETY CLASS EVALUATION FOR GNS-12 CASK
Revision 0 Project Title GNS-12 CASK WO BE1223
Originator A. V. Savino AVS Date 12/27/95
Checker JRG Date 1/10/96

```
PU242    7.7E-10
AM241    5.5E-06
AM243    3.3E-06

--------|---Derived Concentrations-----|
Use when|   measured values are known  |
--------|------------------------------|
Release |Terres. Animal  Drink   Aquatic|
Radio-  |Plant   Product Water   Food   |
nuclide |/kg     /kg     /L      /kg    |
--------|------- ------- ------- -------|

TIME ###########################################################################

1     Intake ends after (yr)
50    Dose calc. ends after (yr)
1     Release ends after (yr)
0     No. of years of air deposition prior to the intake period
0     No. of years of irrigation water deposition prior to the intake period

FAR-FIELD SCENARIOS (IF POPULATION DOSE) ########################################

0           Definition option: 1-Use population grid in file POP.IN
0                              2-Use total entered on this line

NEAR-FIELD SCENARIOS ############################################################

            Prior to the beginning of the intake period: (yr)
0             When was the inventory disposed? (Package degradation starts)
0             When was LOIC? (Biotic transport starts)
0           Fraction of roots in upper soil (top 15 cm)
0           Fraction of roots in deep soil
0           Manual redistribution: deep soil/surface soil dilution factor
0           Source area for external dose modification factor (m2)
TRANSPORT #######################################################################
            ====AIR TRANSPORT=====================================SECTION 1=====
                  0-Calculate PM                 |0        Release type (0-3)
1           Option: 1-Use chi/Q or PM value      |F        Stack release (T/F)
                  2-Select MI dist & dir         |0        Stack height (m)
                  3-Specify MI dist & dir        |0        Stack flow (m3/sec)
4.2E-2      Chi/Q or PM value                    |0        Stack radius (m)
9           MI sector index (1-S)                |0        Effluent temp. (C)
100.0       MI distance from release point (m)   |0        Building x-section (m2)
T           Use jf data, (T/F) else chi/Q grid   |0        Building height (m)

            ====SURFACE WATER TRANSPORT=========================SECTION 2=====
0           Mixing ratio model: 0-use value, 1-river, 2-lake
0           Mixing ratio, dimensionless
0           Average river flow rate for: MIXFLG=0 (m3/s), MIXFLG=1,2 (m/s),
0           Transit time to irrigation withdrawl location (hr)
            If mixing ratio model > 0:
0             Rate of effluent discharge to receiving water body (m3/s)
0             Longshore distance from release point to usage location (m)
0             Offshore distance to the water intake (m)
0             Average water depth in surface water body (m)
0             Average river width (m), MIXFLG=1 only
0             Depth of effluent discharge point to surface water (m), lake only

            ====WASTE FORM AVAILABILITY=========================SECTION 3=====
0           Waste form/package half life, (yr)
0           Waste thickness, (m)
```

ENGINEERING ANALYSIS

Subject TRANSPORTATION SAFETY CLASS EVALUATION FOR GNS-12 CASK
Revision 0 Project Title GNS-12 CASK WO BE1223
Originator A. V. Savino Date 12/27/95
Checker Date 1/10/96

```
0          Depth of soil overburden, m

           ====BIOTIC TRANSPORT OF BURIED SOURCE================SECTION 4=====
T          Consider during inventory decay/buildup period (T/F)?
T          Consider during intake period (T/F)?   | 1-Arid non agricultural
0          Pre-intake site condition..............| 2-Humid non agricultural
                                                  | 3-Agricultural

EXPOSURE ##################################################################

           ====EXTERNAL EXPOSURE================================SECTION 5=====
           Exposure time:                         |  Residential irrigation:
0            Plume (hr)                           | T       Consider: (T/F)
0            Soil contamination (hr)              | 0       Source: 1-ground water
0            Swimming (hr)                        |                 2-surface water
0            Boating (hr)                         | 0       Application rate (in/yr)
0            Shoreline activities (hr)            | 0       Duration (mo/yr)
0          Shoreline type: (1-river, 2-lake, 3-ocean, 4-tidal basin)
0          Transit time for release to reach aquatic recreation (hr)
1.0        Average fraction of time submersed in acute cloud (hr/person hr)

           ====INHALATION=======================================SECTION 6=====
8766.0     Hours of exposure to contamination per year
0          0-No resus-  1-Use Mass Loading          2-Use Anspaugh model
0            pension      Mass loading factor (g/m3)   Top soil available (cm)

           ====INGESTION POPULATION=============================SECTION 7=====
0          Atmospheric production definition (select option):
0            0-Use food-weighted chi/q, (food-sec/m3), enter value on this line
             1-Use population-weighted chi/q
             2-Use uniform production
             3-Use chi/q and production grids (PRODUCTION will be overridden)
0          Population ingesting aquatic foods, 0 defaults to total (person)
0          Population ingesting drinking water, 0 defaults to total (person)
F          Consider dose from food exported out of region (default=F)

           Note below: S* or Source: 0-none, 1-ground water, 2-surface water
                                     3-Derived concentration entered above
           ==== AQUATIC FOODS / DRINKING WATER INGESTION========SECTION 8====

F          Salt water? (default is fresh)

           USE        TRAN-  PROD-    -CONSUMPTION-  |
           ?   FOOD   SIT    UCTION   HOLDUP   RATE  |
           T/F TYPE   hr     kg/yr    da       kg/yr |      DRINKING WATER
           --- ------ -----  -------  ------   -----  |-------------------------
           F   FISH    0.00  0.0E+00    0.00     0.0  | 0     Source (see above)
           F   MOLLUS  0.00  0.0E+00    0.00     0.0  | T     Treatment? T/F
           F   CRUSTA  0.00  0.0E+00    0.00     0.0  | 0     Holdup/transit(da)
           F   PLANTS  0.00  0.0E+00    0.00     0.0  | 0     Consumption (L/yr)

           ====TERRESTRIAL FOOD INGESTION=======================SECTION 9=====

           USE        GROW   --IRRIGATION--          PROD-    --CONSUMPTION--
           ?   FOOD   TIME   S RATE   TIME   YIELD   UCTION   HOLDUP   RATE
           T/F TYPE   da     * in/yr  mo/yr  kg/m2   kg/yr    da       kg/yr
           --- ------ -----  - -----  -----  -----   -------  ------   ------
           F   LEAF V  0.00  0   0.0    0.0    0.0   0.0E+00    0.0      0.0
           F   ROOT V  0.00  0   0.0    0.0    0.0   0.0E+00    0.0      0.0
           F   FRUIT   0.00  0   0.0    0.0    0.0   0.0E+00    0.0      0.0
           F   GRAIN   0.00  0   0.0    0.0    0.0   0.0E+00    0.0      0.0
```

ENGINEERING ANALYSIS

Subject TRANSPORTATION SAFETY CLASS EVALUATION FOR GNS-12 CASK
Revision 0 Project Title GNS-12 CASK WO BE1223
Originator A. V. Savino N/A Date 12/27/95
Checker [illegible] Date 1/10/96

====ANIMAL PRODUCTION CONSUMPTION====SECTION 10====

USE ? T/F	FOOD TYPE	HUMAN CONSUMPTION RATE kg/yr	HUMAN HOLDUP da	TOTAL PRODUCTION kg/yr	DRINK WATER CONTAM FRACT.	STORED FEED DIET FRACTION	STORED FEED GROW TIME da	STORED FEED IRRIGATION S *	STORED FEED IRRIGATION RATE in/yr	STORED FEED IRRIGATION TIME mo/yr	STORED FEED YIELD kg/m3	STORED FEED STOR-AGE da
F	BEEF	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.00	0.0
F	POULTR	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.00	0.0
F	MILK	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.00	0.0
F	EGG	0.0	0.0	0.00	0.00	0.00	0.0	0	0.0	0.00	0.00	0.0
						FRESH FORAGE						
	BEEF					0.00	0.0	0	0.0	0.00	0.00	0.0
	MILK					0.00	0.0	0	0.0	0.00	0.00	0.0

##########

6.3 COMPETENT AUTHORITY

ERLEDIGT [illegible]

U.S.Department of Transportation
Research and Special Programs Administration

COMPETENT AUTHORITY CERTIFICATION
FOR A TYPE B(U)
RADIOACTIVE MATERIALS PACKAGE DESIGN
CERTIFICATE USA/0441/B(U), REVISION 0

REVALIDATION OF GERMAN COMPETENT AUTHORITY CERTIFICATE D/2065/B(U)

This certifies that the radioactive materials package design described below is hereby approved for use within the United States for import and export shipments only. Shipments must be made in accordance with the applicable regulations of the International Atomic Energy Agency[1] and the United States of America.[2]

1. Package Identification - GNS 12.

2. Packaging Description and Authorized Radioactive Contents as described in German Certificate of Competent Authority D/2065/B(U), Rev. 0 (attached).

3. General Conditions -

   a. Each user of this certificate must have in his possession a copy of this certificate and all documents necessary to properly prepare the package for transportation in accordance with the endorsed certificate.

   b. Each user of this certificate, other than the original petitioner, shall register his identity in writing to the Office of Hazardous Materials Technology, (DHM-23), Research and Special Programs Administration, U.S. Department of Transportation, Washington, D.C. 20590-0001.

   c. This certificate does not relieve any consignor or carrier from compliance with any requirement of the Government of any country through or into which the package is to be transported.

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1 "Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Edition" published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

2 Title 49, Code of Federal Regulations, Parts 100 - 199, United States of America.

CERTIFICATE USA/0441/B(U), REVISION 0

d. This certificate is issued only to authorize transport from point of entry to final destination within the United States and from point of origin in the United States to point of exit.

4. Additional Requirement - In addition to or as part of the activities performed under the requirements of the Conditions and Directions section of Certificate D/2065/B(U), the cask cavity shall be leak tested to demonstrate a maximum leak rate of 1×10^{-3} mbar-l/s within the 12-month period prior to shipment.

5. Marking and Labeling - The package shall bear the marking USA/0441/B(U) in addition to other required markings and labeling.

6. Expiration Date - This certificate expires on November 30, 1993.

This certificate is issued in accordance with paragraph 806 of the IAEA Regulations and Section 173.473 of Title 49 of the Code of Federal Regulations, in response to the December 5, 1989 petition and supplementary information submitted by Gesellschaft fur Nuklear-Service mbH, GNS Essen, Germany, and in consideration of other information on file in this Office.

Certified by:

James K. O'Steen

James K. O'Steen, Director
Office of Hazardous Materials Technology

NOV 22 1991
(DATE)

Translation of the German Competent Authority Certificate
No. D/2065/B (U) (Rev. 0)

Bundesamt für Strahlenschutz

(German competent authority for Type B (U) approval)

APPROVAL CERTIFICATE
No. D/2065/B (U) (Rev. 0)

Following the application of the Company GNS Gesellschaft für Nuklear-Service mbH dated 11-4-1987 (marks: HÜg/oh) including safety report dated 11-11-1987 the cask with manufacturer's designation "Shipping cask GNS 12" is approved as a Type B (U) package design for radioactive materials according to the regulations:

Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition (As Amended), of the International Atomic Energy Agency (IAEA), (S 806)

(German) Regulations for the Domestic and International Transportation of Dangerous Goods on Roads (Gefahrgutverordnung Straße - GGVS), dated 7-22-1985, in the version as in the "1. Straßen-Gefahrgut-Änderungsverordnung" dated December 21, 1987 (BGBl. I pg. 2858) (Volume I to the Appendix to BGBl. I No. 62 dated December 1987), Appendix A, item 3672,

European Agreement on the International Transportation of Dangerous Goods on Roads (ADR Agreement), dated 9-30-1957, in the version dated 7-22-1985 (BGBl. I pg. 1550), Appendix A item 3672,

Act for the European Agreement dated 9-30-1957 on the International Transport of Dangerous Goods on Roads (ADR), dated 8-18-1969 (BGBl. II pg 1489), Article 4, Para. 1, No. 2.

(German) Regulations for the Domestic and International Transportation of Dangerous Goods by Rail (Gefahrgutverordnung Eisenbahn-GGVE) dated 7-22-1985, in the version as in the "2. Eisenbahn-Gefahrgut-Änderungsverordnung" dated December 21, 1987 (BGBl. I Pg. 2862) (Volume II to the Appendix to BGBl. I No. 62 dated December 1987), Appendix A, item 1676,

Regulations for the International Transportation of Dangerous Goods by Rail (RID-Rules), Annex I to Appendix to the International Agreement for Railway Goods Traffic (COTIF), dated 5-9-1980, (BGBl. 1985 II, pg. 666) in the version of the regulation dated 7-22-1985 (BGBl. I pg 1560), Appendix, item 1672,

Regulations for the Transportation of Dangerous Goods on the Deep Seas, dated 6-27-1986 (BGBl. I, pg 961), in the version as in the "3. See-Gefahrgut-Änderungsverordnung" dated 12-21-1987 (BGBl. I pg. 2863), IMDG-Code german, class 7, Section 12.1, No. 3 page 7033,

International Maritime Dangerous Goods Code (Class 7, 12.1, 3 page 7033)

Regulations for the Transportation of Dangerous Goods on the Rhine (ADNR) dated 11-23-1971, (BGBl. I pg. 1851), amended by the ADNR - Revison 6, dated 3-24-1983 (BGBl. I pg 367), item 6461 (3),

Publication about the Transport of Dangerous Goods inclusive weapons on airways, News for Aviation (NfL) Part I, dated 7-14-1988, 36 th annual set, NfL I 114-115/88 pg. 185; in connection with "International Civil Aviation Organisation Technical Instructions for the Safe Transport of Dangerous Goods by Air" (ICAO-II) 7.5.5 a., 1989 - 1990.

In connection with the Guide-lines of the Federal Minister of Transport dated 10-18-1977 (VkBl. 31. (1977) pg. 582)

We herewith confirm, that the "Bundesamt für Strahlenschutz, Salzgitter" is the competent authority following Section 22 of IMDG Code german as decided by the Federal Ministry of Traffic.

Owner of the Certificate:

G N S Gesellschaft für Nuklear-Service mbH
Zweigertstrasse 28-30
4300 Essen 1, West Germany

Designation of the package design:

D/2065/ B (U)

This approval is valid until November 30, 1992 (inclusively),

- 3 -

Allowable Contents:

Maximum three stainless steel canisters filled with vitrified radioactive material (type: "GSP-Glaskokillen") ("GSP-glass canisters")

They contents the following radioactive nuclides:

- Caesium-137, activity: max.: 1.1×10^{16} Bq
- Strontium-90/Yttrium-90, activity: max.: 7.7×10^{15} Bq
- natural Thorium-oxid < 2 weight-%
- Plutonium < 3 g
- Natural Uranium ≤ 10 g

Weight (of the glass) : approx. 200 kg

Thermal power per canister : max.: 2285 Watts

Dose rate:
At the surface of the cask (calculated with "Isoshield") : 1 m Sv/h

Design of the Packaging:

The design "Transport cask GNS 12" meets the requirements for a type B(U)-package given by the IAEA-Regulations, paras 228 to 241. This is shown by the "Prüfungszeugnis" of the "Bundesanstalt für Materialforschung und -prüfung (BAM)", dated 7-11-1988 - file: 1.5/22 141.

Description of the Packaging:

The shipping cask "GNS 12" consists of a welded stainless steel construction with shielding of lead to contain three stainless steel canisters. The body of the cask is manufactured as a sandwich construction with an outer and an inner stainless steel container with a lead filling between them. For fixation of the above radioactive material, a basket is inserted into the cask cavity. The tight enclosure is realized for this design by:

- the cask body
- the shielding lid with boltings and elastomer seals
- the penetrations in the shielding lid with its seal rings, plugs and boltings.

Dimensions:	without impact limiters	with impact limiters
Height	1535 mm	approx.: 2060 mm
Diameter	1050 mm	approx.: 1650 mm
max. entire weight:	11100 kg	approx.: 12500 kg

General Drawing:

"Transportbehälter GNS 12", drawing No.:
B 510.12 Rev. c, dated 3-22-1988

Conditions and directions:

1. All quality assurance procedures for design, controls during fabrication and operation must be executed in compliance with the PTB/BAM paper for Quality Assurance Procedures (Amts- und Mitteilungsblätter of PTB and BAM, December 1982). The competent authority "Physikalisch-Technische Bundesanstalt (PTB)" named there is to be replaced by "Bundesamt für Strahlenschutz". Before starting manufacturing of further casks a revised Quality Assurance Programme is to cleared with the competent authorities.

2. This approval is valid only in connection with the final inspection certificate for the serial cask concerned.

3. Prior to be first utilization it has to be assured that each user of the package is registered with Bundesamt für Strahlenschutz and that the user confirms that he has received and complies with the testbook, containing the cask design approval, the Procedure for Handling and Maintenance and the Testing Procedure for Periodic Inspections.

4. Each package has to show the above-mentioned identification mark together with the date of the next periodic inspection on a reliably fixed plate.

5. Each package has to be subjected to Periodic Inspections in due time.

6. Subsequent changes of the drawings, part lists and material data sheets, which are the basis of this Approval, need authorization by Bundesamt für Strahlenschutz prior to start of fabrication.

7. The package has to be transported as a full load or a closed load (by train) if the cask is filled. The requested limits for the dose-rate must be met, eventually by means of shielding at the vehicle. The package has to be transported with fixed shock absorbers.
Furthermore, there no other additional requirements for the transport.

8. This approval does not release the shipper from the obligation to observe the regulations of each country affected by the transport.

Legal instructions:

Objections can be raised to this ruling within one month after publication. The objection is to be submitted in writing or by presentation at Bundesamt für Strahlenschutz, Albert-Schweitzer-Str. 18, 3320 Salzgitter 1.

Braunschweig, November 6, 1989
(signed by)
Dr. Cosack

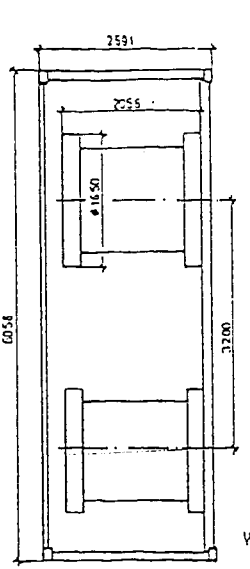
Attachments

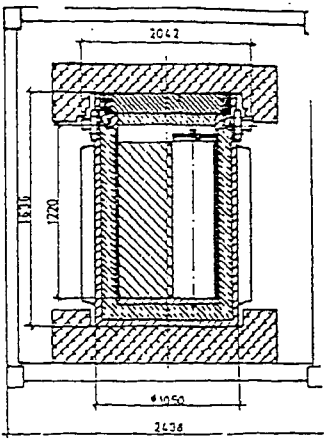
Appendix to the approval
Drawing: Z 525.120-85

Appendix to Approval Certificate

No. D/2065 / B(U) (Rev. 0)

Revision No.	Date of issue	Date valid until	Reason for revision
0	11-6-1989	11-30-1992	first edition





Kapazität / Behälter
Capacity of the packaging

3 GSF - Kokillen / Canisters
Wärmeinhalt / Heat Content max. 6855 W

Massen / Versandstück
Masses / Package

Versandstück / Package	12,5 t
Kokillen / Canisters	0,21 t
Leergewicht / Tare Weight	12,3 t
Deckelstoßdämpfer / Lid Shock Absorber	0,8 t
Bodenstoßdämpfer / Bottom Shock Absorber	0,74 t
Primärdeckel / Primary Lid	1,05 t

Bei Verwendung eines 20'-Containers
With use of a 20'-Container

Transportgewicht / Transport Weight (max. 2 Versandstücke / Packages)	29 t
Tara / Tare Weight	4 t
Mindestlüftungsquerschnitt / Minimum Ventilation Area	0,18 m²

WP— K 10855

Bundesamt für Strahlenschutz

Zulassungsschein

D/2065/B(U) (Rev. 2)

Aufgrund des Antrages der Firma GNS Gesellschaft für Nuklear-Service mbH vom 04.11.1987 (A.Z.: HUg/oh) mit Zustellung des Sicherheitsberichts GNS 850/87 vom 13.11.1987 und Mitteilung vom 15.01.1990 - TF 214 - wird der Behälter mit der Herstellerbezeichnung - Transport-behälter GNS 12 - als Versandstückmuster des Typs B(U) für radioaktive Stoffe nach den folgenden Vorschriften zugelassen:

Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition (As Amended) der International Atomic Energy Agency (IAEA), § 805,

Verordnung über die innerstaatliche und grenzüberschreitende Beförderung gefährlicher Güter auf Straßen (Gefahrgutverordnung Straße - GGVS) vom 22.7.1985, zuletzt geändert durch die 1. Straßen-Gefahrgut-Änderungsverordnung vom 21. Dezember 1987 (BGBl. I S. 2858) (Anlageband I zum BGBl. I Nr. 62 vom 30. Dezember 1987), Anlage A, Randnummer 3672,

Europäisches Übereinkommen über die internationale Beförderung gefährlicher Güter auf der Straße (ADR-Übereinkommen) vom 30. September 1957 in der Fassung vom 22. Juli 1985 (BGBl. I S. 1550), Anlage A, Randnummer 3672,

Gesetz zu dem Europäischen Übereinkommen vom 30. September 1957 über die internationale Beförderung gefährlicher Güter auf der Straße (ADR) vom 18. August 1969 (BGBl. II S. 1489), Artikel 4 Abs. 1 Nr. 2,

Verordnung über die innerstaatliche und grenzüberschreitende Beförderung gefährlicher Güter mit Eisenbahnen (Gefahrgutverordnung Eisenbahn - GGVE) vom 22.7.1985, zuletzt geändert durch die 2. Eisenbahn-Gefahrgut-Änderungsverordnung vom 21. Dezember 1987 (BGBl. I S. 2862) (Anlageband II zum BGBl. I Nr. 62 vom 30. Dezember 1987), Anlage A, Randnummer 1672,

Ordnung für internationale Eisenbahnbeförderung gefährlicher Güter (RID-Regeln) - Anlage I zu Anhang B des Übereinkommens über den internationalen Eisenbahnverkehr (COTIF-Übereinkommen) vom 9. Mai 1980 (BGBl. 1985 II S. 666), in der Fassung der Verordnung vom 22. Juli 1985 (BGBl. I S. 1560), Anlage, Randnummer 1672,

- Blatt 2 des Zulassungsscheines D/2065/B(U) (Rev.2) -

Gefahrgutverordnung See in der Fassung der Bekanntmachung vom 27. Juni 1986 (BGBl. I S. 961), zuletzt geändert durch die 3. See-Gefahrgut Änderungsverordnung vom 21. Dezember 1987 (BGBl. I S. 2863), IMDG-Code deutsch, Klasse 7, Abschnitt 12.1, Ziffer) Seite 7033,

International Maritime Dangerous Goods Code (Class 7, 12.1, 3, Page 7033),

Verordnung über die Beförderung gefährlicher Güter auf dem Rhein (ADNR) vom 23.11.1970, (BGBl. I S. 1651), zuletzt geändert durch die 6. ADNR-Änderungsverordnung vom 24.03.1983, (BGBl. I S. 367), Randnummer 6461 (3),

Bekanntmachung über die Beförderung gefährlicher Güter einschließlich Waffen im Luftverkehr, Nachrichten für die Luftfahrer Teil I vom 14.07.1988 36. Jahrg., NfL I 114-115/88 S. 185; in Verbindung mit den "International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO-TI) 7.9.5 a., 1989 - 1990.

in Verbindung mit den Richtlinien des Bundesministers für Verkehr vom 18.10.1977 (VkBl. 31. (1977) S. 382).

Es wird bestätigt, daß das Bundesamt für Strahlenschutz, Salzgitter, vom Bundesministerium für Verkehr autorisierte Behörde gemäß Abschnitt 22 des IMDG-Code deutsch ist.

Genehmigungsinhaber: GNS Gesellschaft für Nuklear-Service mbH
Goethestr. 88
4300 Essen 1

Kennzeichen des Versandstückmusters: D/2065/B(U)

Gültigkeit der Zulassung: bis einschließlich 30. November 1992

Zulässiger Inhalt:

Maximal drei Edelstahlkokillen gefüllt mit verglasten radioaktiven Stoffen (Typ: "CSF-Glaskokillen")

Enthaltend je Kokille folgende radioaktive Nuklide:

- Cäsium-137	Aktivität:	max.:	$1{,}1 \times 10^{16}$ Bq
- Strontium-90 / Yttrium-90	Aktivität:	max.:	$7{,}7 \times 10^{15}$ Bq
- Thoriumoxid natürlich (ThO_2)			< 2 Gew. % (Glas)
- Plutonium, gesamt:			< 3 g

Nuklidvektor Plutonium (Gew. %)

Pu-238	0,34
Pu-239	90,00
Pu-240	8,17
Pu-241	0,77
Pu-242	0,39

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- Uran, gesamt:	< 10 g
Nuklidvektor Uran (Gew. %)	
U-234	0,0035
U-235	0,574G
U-236	0,0683
U-238	99,03
- Americium-241	< 0,1 g
- Americium-243/244	< 1,0 g
Masse (Glas) je Kokille:	max.: 200 kg
Wärmeleistung je Kokille:	max.: 2255 W

Dosisleistung:

An der Behälteroberfläche (Beladung mit 3 Kokillen): ca. 1 mSv/h
(Rechnung mit "Isoshield")

Bauart der Verpackung:

Die Bauart Transportbehälter GNS 12 erfüllt laut Prüfungszeugnis der Bundesanstalt für Materialforschung und -prüfung (BAM), vom 11. Juli 1988 - Aktenzeichen: 1.5 / 22 141 - die an ein Typ B(U)-Versandstück gestellten Anforderungen (IAEA-Regulations, § § 223 bis 241)

Beschreibung der Verpackung:

Der Transportbehälter GNS 12 besteht aus einer geschweißten Edelstahlkonstruktion mit Bleiabschirmung zur Aufnahme von drei Edelstahlglaskokillen. Der Behälterkörper ist in Sandwichbauweise hergestellt mit einem äußeren und inneren Edelstahlbehälter und einer dazwischen liegenden Bleifüllung. Zur Fixierung des Inhalts ist im Behälterschacht ein Tragkorb eingesetzt. Die dichte Umschließung wird bei der vorliegenden Bauart gebildet von:

- dem Behältergrundkörper
- dem Abschirmdeckel mit Verschraubung und Elastomerdichtringen
- den Verschlußasen im Abschirmdeckel einschließlich deren Dichtringen und Verschraubung.

Maße:	ohne Stoßdämpfer	mit Stoßdämpfer
Höhe:	1 535 mm	ca. 2 060 mm
Durchmesser:	1 050 mm	ca. 1 650 mm
max. Gesamtmasse:	11 100 kg	ca. 12 500 kg

Übersichtszeichnung:

Transportbehälter GNS 12 Zeichnung-Nr.: B 510.12 Rev. c vom 22.03.1988

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Nebenbestimmungen und Hinweise:

1. Alle qualitätssichernden Maßnahmen bei der Planung, den begleitenden Kontrollen und dem Betrieb müssen entsprechend den Maßgaben des PTB/BAM-Merkblattes über qualitätssichernde Maßnahmen (Amts- und Mitteilungsblätter von PTB und BAM, Dezember 1982) erfolgen. Die dort genannte zuständige Behörde "Physikalisch-Technische Bundesanstalt (PTB)" ist durch "Bundesamt für Strahlenschutz" zu ersetzen. Vor Fertigung weiterer Behälter ist ein überarbeitetes Qualitätssicherungsprogramm mit den zuständigen Behörden abzustimmen.

2. Diese Zulassung gilt nur in Verbindung mit dem für das betreffende Serienmuster erstellten Endabnahmeschein.

3. Es ist sicherzustellen, daß sich jeder Verwender der Verpackung vor der erstmaligen Benutzung bei dem Bundesamt für Strahlenschutz registrieren läßt und bestätigt, daß er das Prüfbuch erhalten hat, das insbesondere den Zulassungsschein, die Bedienungs- und Wartungsanleitung und den Prüfplan zur wiederkehrenden Prüfung enthält, erhalten hat und beachtet.

4. Jedes Serienmuster ist mit dem oben angegebenen Kennzeichen und mit der Frist bis zur nächsten wiederkehrenden Prüfung dauerhaft zu versehen.

5. Jedes Serienmuster ist rechtzeitig wiederkehrenden Prüfungen zu unterziehen.

6. Änderungen bezüglich der Zeichnungen, Stücklisten und Werkstoffdatenblätter, die der Zulassung zugrunde liegen, bedürfen vor Beginn der Fertigung der Genehmigung durch das Bundesamt für Strahlenschutz.

7. Das Versandstück ist bei voller Beladung als geschlossene Ladung oder im Schienenverkehr als Wagenladung zu befördern. Die vorgeschriebenen Grenzwerte der Dosisleistung sind evtl. durch Abschirmung am Fahrzeug einzuhalten. Das Versandstück ist mit montierten Stoßdämpfern zu befördern. Weitere besondere Maßnahmen während der Beförderung sind nicht erforderlich.

8. Diese Zulassung entbindet den Absender nicht von der Notwendigkeit, etwaige Vorschriften des jeweiligen Landes, das vom Transport mit diesem Versandstück berührt wird, zu beachten.

Rechtsbehelfsbelehrung:

Gegen diesen Bescheid kann innerhalb eines Monats nach Bekanntgabe Widerspruch erhoben werden. Der Widerspruch ist bei dem Bundesamt für Strahlenschutz, Albert-Schweitzer-Str. 18, 3320 Salzgitter1, schriftlich oder zur Niederschrift einzulegen.

Braunschweig, den 08. Februar 1990

Im Auftrag

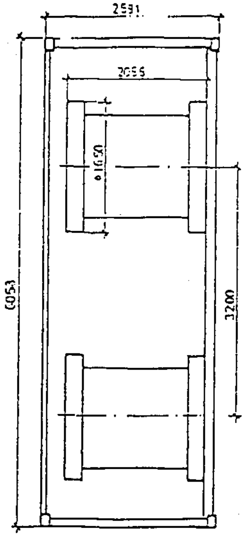
Dr. Losack

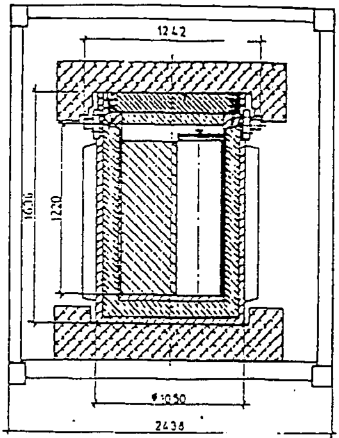
BUNDESAMT FÜR STRAHLENSCHUTZ

Anlagen
Anhang zum Zulassungsschein
Übersichtsskizze: E 525.120-85

Anhang zum Zulassungsschein D/2065/D(U) (Rev.2)

Rev.Nr.	Ausstellungs-datum	Gültigkeits-dauer	Grund der Revision
0	06.11.1989	30.11.1992	Erstausstellung
1	15.12.1989	30.11.1992	Klarstellung zum Inhalt
2	07.02.1990	30.11.1992	Klarstellung zum Inhalt





Kapazität / Behälter
Capacity of the packaging

3 GSF - Kokillen / Canisters
Wärmeinhalt / Heat Content max. 6655 W

Massen / Versandstück
Masses / Package

Versandstück / Package	12,5 t
Kokillen / Canisters	0,23 t
Leergewicht / Tare Weight	17,7 t
Deckelstoßdämpfer / Lid Shock Absorber	0,8 t
Bodenstoßdämpfer / Bottom Shock Absorber	0,74 t
Primärdeckel / Primary Lid	1,05 t

Bei Verwendung eines 20'-Containers
With use of a 20'-Container

Transportgewicht / Transport Weight (max. 2 Versandstücke / Packages)	29 t
Tara / Tare Weight	4 t
Mindestluftungsquerschnitt / Minimum Ventilation Area	0,18 m

GNS
U-4300 ESSEN GERMANY

GNS 12
TB mit Transportcontainer

E 525.120-85
REV.

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DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	Packaging Engineering	Date 03/27/96
Project Title/Work Order		EDT No. NA
GNS-12 Packaging Design Criteria (WHC-SD-TP-PDC-033)		ECN No. 630861

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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WHC-SD-TP-PDC-033 File	G1-11	X			