

U.S. DEPARTMENT OF ENERGY  
**CERTIFICATE OF COMPLIANCE**  
For Radioactive Materials Packages

1a. Certificate Number 9761	1b. Revision No. 2	1c. Package Identification No. USA/9761/BX DOE	1d. Page No. 1	1e. Total No. Pages. 6
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2. PREAMBLE

- 2a. This certificate is issued under the authority of 49CFR Part 173.7 (d).
- 2b. The packaging and contents described in Item 5 below, meets the safety standards set forth in subpart E, "Package Approval Standards" and subpart F, "Package and Special Form Tests" Title 10, Code of Federal Regulations, Part 71.
- 2c. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. This certificate is issued on the basis of a safety analysis report of the package design or application—

(1) Prepared by (Name and address):

U.S. Department of Energy  
Idaho Operations Office  
785 DOE Place  
Idaho Falls, Idaho 83402

(2) Title and Identification of report or application:

Safety Analysis Report for Packaging  
Krypton-85 Shipment Packaging in the Super Tiger  
Shipping Overpack - Westinghouse Idaho Nuclear  
Co., Inc. Report No. WIN-232, October 1987

(3) Date:

October 1987

4. CONDITIONS

This certificate is conditional upon the fulfilling of the applicable Operational and Quality Assurance requirements of 49CFR parts 100-199 and 10CFR Part 71, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Fissile Class, Other Conditions, and References:

a) Packaging

(1) Model Number: CA-WN-901 Krypton Shipping Container

(2) Description: The krypton packaging is designed for quantities of krypton gas less than 74,000 curies and consists of three separate and distinct components. The containment vessel is a nominal 1.5 ft<sup>3</sup> compressed gas cylinder, 3AA2015 (49 CFR 178.37). The containment vessel is held within a lead filled carbon steel shield container which is further held within a wood and foamglass filled stainless steel thermal insulating overpack. The minimum thickness of the lead shielding is 2 inches. The overall packaging dimensions are 30 inches in diameter by 83½ inches long. A tubular stainless steel support frame assembly is welded to the surface of the insulating overpack. The gross weight of the packaging is 5200 pounds.

(3) Drawings

The packaging is constructed as shown in Figures 1, 3, and 4 and as specified in Chapter 10 of Westinghouse Idaho Nuclear Company Inc. Report Number WIN-231 September 1987; Drawing Numbers 12176-CPP-604-M-5, 6, 7, 8, 9, 10, and 11. A sketch of the Krypton package is given in Figure 1.

6a. Date of Issuance: November 3, 1987	6b. Expiration Date: December 31, 1987
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FOR THE U.S. DEPARTMENT OF ENERGY

7a. Address (of DOE Issuing Office) U.S. Department of Energy Washington, D.C. 20545	7b. Signature, Name, and Title (of DOE Approving Official) <i>Julio L. Torres</i> Julio L. Torres, Director Office of Security Evaluations Defense Programs
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**(b) Contents****(1) Type and form of material.**

Compressed Krypton-85 gas in mixture with other non radioactive gases that are chemically compatible with the 3AA2015 cylinder. No fissile material.

**(2) Maximum quantity of material per package.**

Radioactivity not to exceed 8,000 curies. Maximum internal decay heat not to exceed 12 watts. Maximum volume of Krypton-85 and other non radioactive gases shall not exceed 900 liters at STP (1 atm, 25°C).

**(c) Fissile Class**

No fissile material in package.

**(d) Conditions****(1) Limitations**

- (i) The maximum initial fill pressure shall not exceed 500 psig at 25°C.
- (ii) The DOT Specification 3AA2015 gas cylinder shall be certified for an operating load of 2015 psig, at least once every 5 years by testing to 3360 psig.
- (iii) A minimum of 24 hours after loading with krypton-85 gas the krypton packaging primary containment shall have a leak rate of less than 0.0014 microcuries per second. The leak test shall be performed with the containment vessel within the lead shield container prior to placement within its thermal overpack.
- (iv) Contents of the package shall be verified by mass spec analysis.
- (v) Measured dose rates external to the krypton package shall not exceed 200 millirem/hour on the accessible external surface of the package and 10 millirem/hour at any point 2 meters from the vertical planes represented by the outer lateral surfaces of the package.

- (vi) Acceptance, maintenance and use of the krypton package shall be in accordance with the procedures and requirements of Chapter 7 and 8 of Westinghouse Idaho Nuclear Company, Inc. Report No. WIN-231, September 1987.

(2) Restrictions

- (i) This certificate is applicable to shipment of Krypton-85 gas from Idaho Falls, Idaho to Oak Ridge, Tennessee in the CA-WN-901 krypton shipping container.
- (ii) The krypton package shall be transported within the NRC certified Model 6400 Super Tiger packaging - USA/6400/B( )F in a manner consistent with the conditions specified in the 6400 certificate of compliance as follows:
- a. The position and securement of the krypton package (See Figure 2) within the Super Tiger overpack, model number 6400, is as specified in drawing 059888, Westinghouse Idaho Nuclear Company, Inc. Report No. WIN-232, September 1987.
  - b. Krypton package must be enclosed within a tight fitting plywood box constructed in accordance with Westinghouse Idaho Nuclear Company, Inc. drawing 059886.
  - c. The maximum weight of the krypton package including secondary packaging, dunnage, shoring and bracing must not exceed 30,000 pounds.
  - d. Dunnage, shoring and/or bracing must be utilized to minimize secondary impact of the krypton package within the model 6400 cavity under accident conditions.
  - e. The krypton package must be positioned within the Model 6400 cavity such that the center of gravity of the loaded model 6400 package is substantially the same as the center of gravity of an empty package.
6. The package authorized by this certificate is hereby approved for use under the authority of 49 CFR 173.7(d).
7. Expiration date: December 31, 1987

REFERENCES

Westinghouse Idaho Nuclear Company, Inc. Report No. WIN-231  
September 1987

Westinghouse Idaho Nuclear Company Inc. Report  
No. WIN-232, Rev. 3, October 6, 1987

Certificate of Compliance for Radioactive Materials packages, NRC Certificate  
No. 6400, Revision No. 19, December 1986

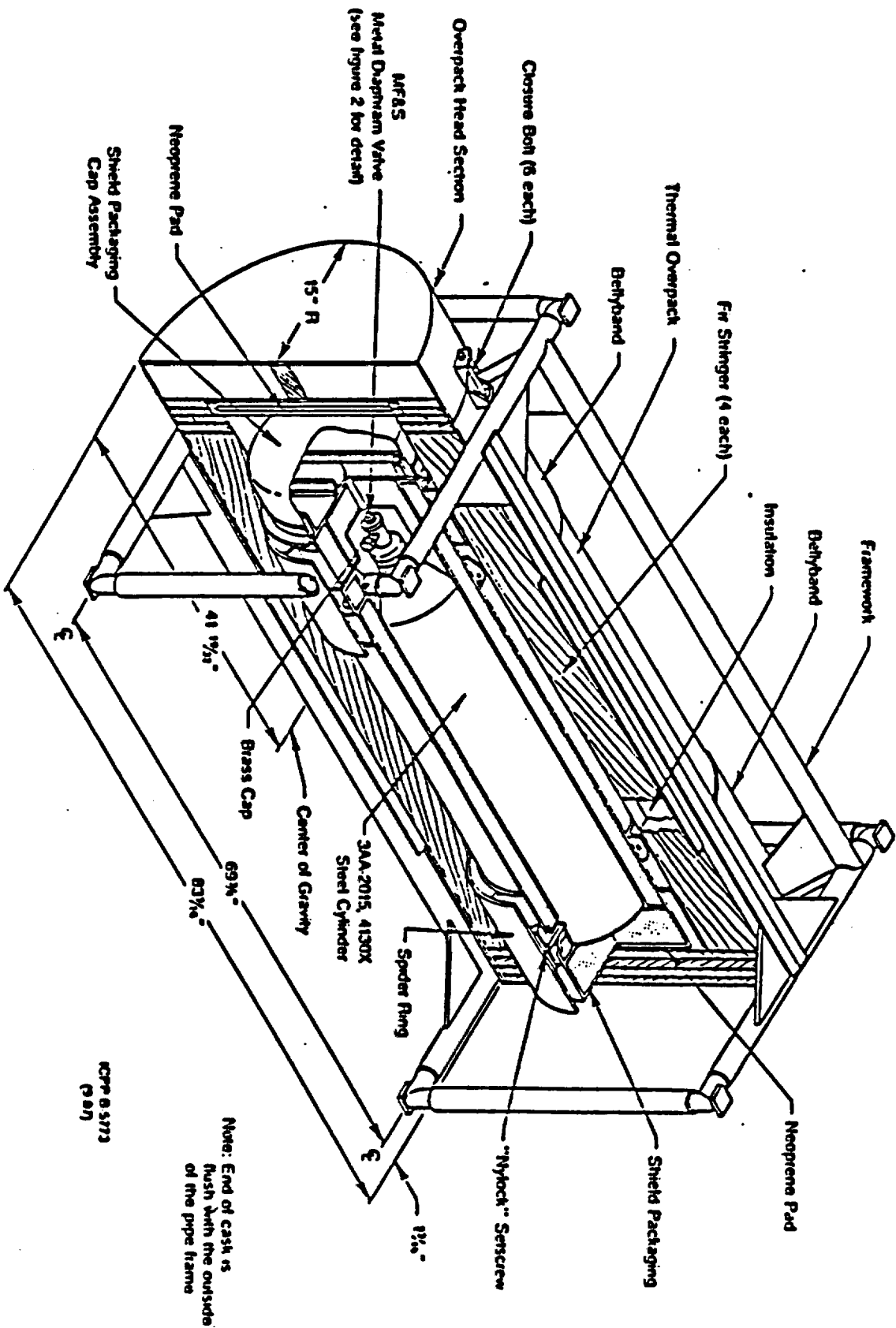


Figure 1. Krypton Package

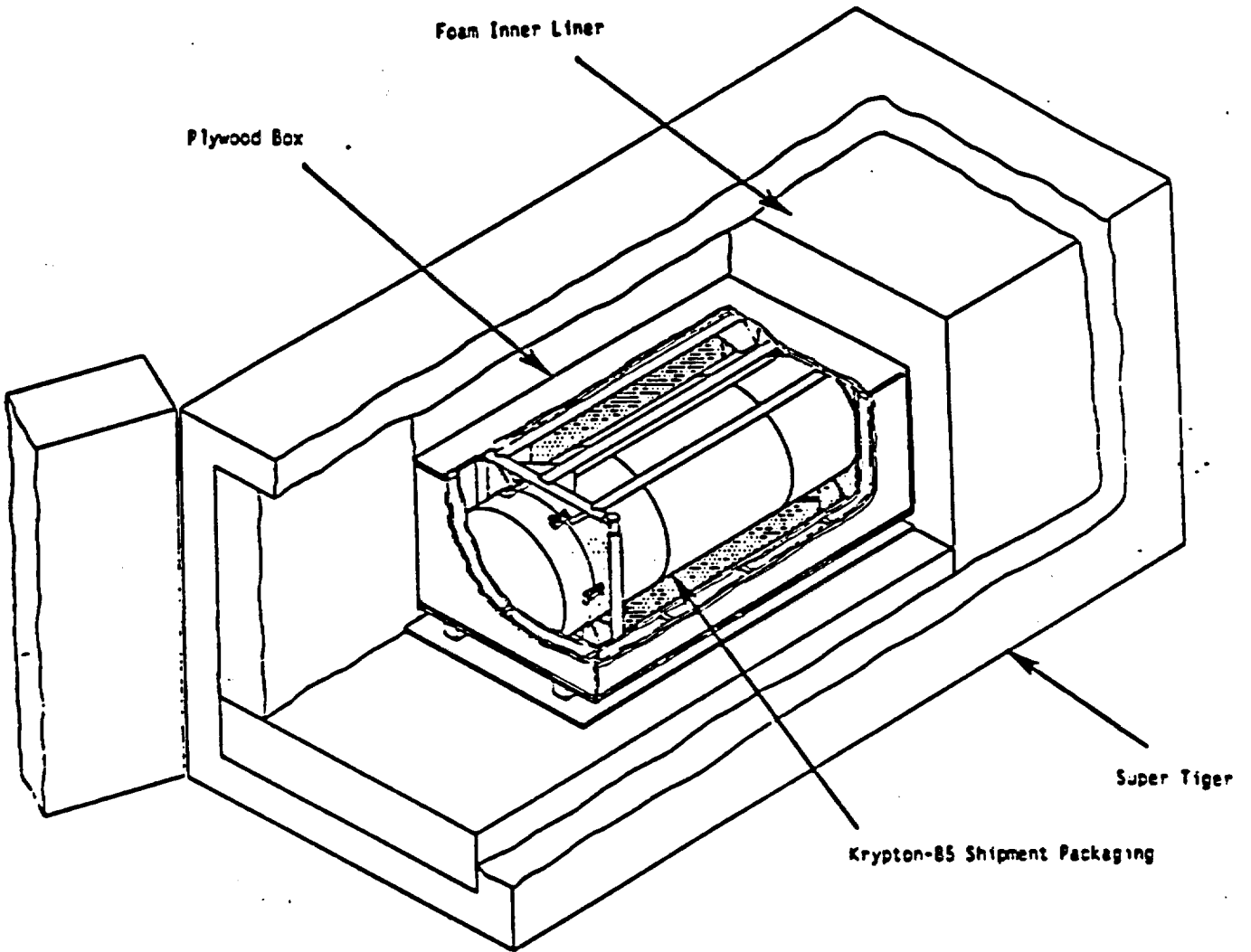


Figure 2.  
Krypton Package in the Super Tiger

Packaging Certification Branch  
Office of Security Evaluations  
Approval Record  
Model No. CA-WN-901 Krypton Shipping Container  
Docket No. 87-15-9761  
Revision No. 2

By application dated October 28, 1987, DOE-ID has requested approval for two additional shipments using the Model No. CA-WN-901 Krypton Shipping Container in the Super Tiger overpack. The shipments will consist of 3400 and 750 curies of compressed Krypton-85 gas which is less than the 8000 curie maximum that the package was previously certified for. There have been no changes made to the previously approved packaging.

Since the requested shipments will have contents within the previously approved limits, the certificate has been amended to allow the two additional shipments of compressed Krypton-85 gas in the Krypton Shipping Container and Super Tiger overpack.

The above change will not effect the ability of the package to meet the requirements of 10 CFR Part 71.

*Julio L. Torres*  
Julio L. Torres, Director  
Office of Security Evaluations  
Defense Programs

Date: 10/21/87

Department of Energy  
Washington, D.C.

Packaging Certification Branch  
Office of Security Evaluations

Safety Evaluation Report  
Model No. CA-WN-901 Krypton  
Shipping Container  
Docket No. 87-15-9761

By application, the Idaho Operations Office requested certification of the Model No CA-WN-901 Krypton Shipping Container for a one-time, one-way shipment from Idaho Falls, Idaho to Oak Ridge, Tennessee. The Model No. CA-WN-901 krypton package is an improved and newly manufactured package of the design previously approved by the Department of Energy and the Nuclear Regulatory Commission for shipment of 74,000 Ci of compressed krypton gas.

To ensure safety for a one-time shipment of a limited quantity (<8000Ci) of krypton gas the CA-WN-901 krypton package will be transported within the NRC certified Model 6400 Super Tiger overpack. The Super Tiger overpack will provide the impact and thermal protection for the krypton package thus reducing the structural and thermal environments to the krypton package to inconsequential levels.

The Safety Analysis Report for Packaging for the one-time transport of the krypton package within the Super Tiger (Reference 2) has been reviewed and found to adequately address the safety requirements of 10 CFR 71. The following confirmatory analyses and assessments were made.

General Information

The information presented in the General Information Chapter of the SARP is in compliance with the Reg. Guide 7.9 and provides a clear, concise description of the proposed combined packagings. Material callouts for both the Super Tiger overpack and the Krypton packaging containment system are sufficient for compatibility analysis. Proposed contents for this one-time, one-way shipment are adequately discussed and packaging gross weights presented. The drawings are sufficient to illustrate the necessary added structure to interface with the Super Tiger payload cavity.

Structural

Use of the krypton packaging for shipping krypton had been certified previously for curie quantities nearly ten times as large as this one-time shipment. This shipment uses the same DOT 3AA2015 gas cylinder with an improved valve to contain the krypton and the same shield as approved previously. The krypton thermal overpack is newly manufactured with improved materials. The Model 6400 Super Tiger packaging is a currently certified overpack for transporting contents that can be heavier and generate more heat, by factors of two to four than the krypton package. The proposed method of restraining the Krypton packaging in the Super Tiger (i.e. large



blocks of high density foam) is similar to one specifically approved in the Super Tiger certification.

The krypton package in conjunction with the Super Tiger meets the structural performance specifications of 10 CFR 71.71 and 73. The krypton package has been shown to safely withstand g levels of nearly 200 g's with no loss of shielding or damage to the containment system. When transported within the Super Tiger with thick polyurethane dunnage, the loads transmitted to the krypton package are calculated to be less than 80 g's for all drop orientations.

The method of supporting the Krypton package in the Super Tiger Packaging has been reviewed to ascertain that the polyurethane blocks will be strong enough to transmit the loads that will be generated and that it will prevent any detrimental movement of the packaging during shipment. Protection against puncture of the krypton packaging is adequately provided for by the use of the Super Tiger.

### Thermal

Temperatures and pressures calculated in the SARP have been overchecked and found to be acceptable. Results of the SARP thermal analysis under Normal Conditions of Transport, are that the maximum temperature in the entire system is 180°F which corresponds to a Krypton gas pressure of about 359 psig. In the Super Tiger, under Hypothetical Accident Conditions (thermal), the temperature of the contents will rise no more than 10°F, with a correspondingly small increase in krypton gas pressure.

To verify the results presented in the SARP, an independent thermal evaluation was conducted. A worst case one dimensional calculation was performed that included the following assumptions (a) all the heat is transferred through an equivalent polyurethane cylinder with outside radius, inside radius, and length of 61.1, 33.1, and 72 inches, respectively; and (b) the thermal conductivity of polyurethane is 0.01 Btu/hr-ft-F. This calculation produced a krypton gas temperature close to that stated in the SARP, namely 182°F, and a krypton gas pressure of about 360 psig. The worst case temperature and pressure (182°F and 360 psig) remain below the allowable values for the krypton gas containment boundary (392°F and 1000 psig) and Super Tiger.

The Super Tiger surface temperature is acceptable because the contents are limited to 12 watts whereas Super Tiger is certified to transport up to 30 Watts.

### Containment

The contents are compressed, radioactive, gaseous Krypton-85 and associated non-radioactive gases contained in a DOT 3AA2015, 4130X steel, compressed gas cylinder equipped with a Manifold Fabricators and Supply metal diaphragm valve. The release rate criteria specified for the containment is 0.0014 Ci/s maximum as measured before shipment. This meets the containment requirement of 10 CFR 71.51 for compressed Krypton-85 under normal conditions of transport. Assembly verification for the containment before each shipment is accomplished by the leak rate measurement before shipment to ensure that the 0.0014 Ci/s release is not exceeded.

Containment under accident conditions is met because the entire contents is limited to less than 10,000 Ci. 10 CFR 71.51 allows release of up to 10,000 Ci/week of Krypton-85 under accident conditions.

### Shielding

Confirmatory calculations were made using microshield 2.02 for a krypton loading of 7,800 Ci. The applicant's dose rates and the overcheck values are presented in the Table below.

CALCULATED DOSE RATES		
<u>ITEM</u>	<u>APPLICANT'S SARP VALUE</u>	<u>OVERCHECK VALUE</u>
<u>BARE CYLINDER</u>		
SURFACE	185 (Rem/hr)	165
1-METER	2.6	6.0
<u>LEAD SHIELD</u>		
SURFACE	5.0 (mRem/hr)	0.8
1-METER	2.0	0.1

Based upon the review of the Krypton SARP, confirmatory calculations, and the constraint that the lead shield remain in place during all transport conditions, the packaging meets 10 CFR 71.47 requirements for radiation levels.

### Operating Procedure

Loading of the Krypton container with Krypton-85 gas is done in accordance with long-standing operating procedures as referenced in the SARP. Loading of the Krypton shipment package into its shipping box is adequately described and calls for appropriate shipping agent overview. The final loading of the shipping box into the Super Tiger is clearly described and illustrated.

The contents of the primary containment are verified by mass spec analysis before shipment and the necessary procedures for leak checking and radiation surveys during package loading - prior to shipment, are presented in Section 8.0 or the SARP.

### Quality Assurance

The QA section in the SARP has been evaluated for compliance with Subpart II of 10 CFR 71 and with the 18 elements of ANSI/ASME NQA-1 for this proposed one-time, one-way shipment. The applicable WINCO Quality Program Manual, IPM-VIII, has been reviewed and found to be acceptable.



DOCKET NO. 71-6400  
CONTROL NO. 24420  
DATE OF DOC. June 6, 1988  
DATE RCVD. June 16, 1988  
FCUF \_\_\_\_\_ PDR   
FCAF \_\_\_\_\_ LPDR \_\_\_\_\_  
I & E REF.   
SAFEGUARDS \_\_\_\_\_  
OTHER \_\_\_\_\_  
FCTC   
DATE 6/16/88 INITIAL cc