U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: WASTE PACKAGE

DESIGN ASSESSMENTS -

CRITICALITY AND STRUCTURAL

ANALYSES

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# POTENTIAL CONFIGURATIONS FOR CRITICALITY CALCULATIONS

CONFIGURATION NUMBER	DESCRIPTION
1	*NOMINAL CONFIGURATION - DRY*
2	*NOMINAL CINFIGURATION - FLOODED*
3	NOMINAL CONFIGURATION - PARTIAL FLOODING
4	STRUCTURE GONE - RODS UNIFORMLY SPACED - DRY
5	STRUCTURE GONE - RODS UNIFORMLY SPACED - FLOODED
6	*CONTAINER PARTIALLY GONE - OPTIMAL REARRANGEMENT OF RODS - FLOODED*
7	STRUCTURE AND CLAD GONE - PILE OF PELLETS - DRY
8	STRUCTURE AND CLAD GONE - PILE OF PELLETS - FLOODED
9	STRUCTURE AND CLAD GONE - PELLETS DISINTEGRATED TO POWDER - DRY
10	*CLAD AND DISINTEGRATED PELLETS (POWDER) OPTIMALLY MIXED - FLOODED*
11	STRUCTURE AND CLAD GONE - PELLETS DISINTEGRATED TO POWDER - FLOODED

NOTES: STRUCTURE IS DEFINED AS THE CONTAINER AND CANISTER;
ANALYZED CONFIGURATIONS ARE SHOWN IN ITALICS

REF: UCRL-53595

CONFIGURATION 6 -
PARTIAL CONTAINER FAILURE

- OPTIMUM ROD REARRANGEMENT
- FLOODED

Pitch = .561 in.

Container
(space frame)
carbon steel

Fuel rods
(close-packed
triangular
pitch)
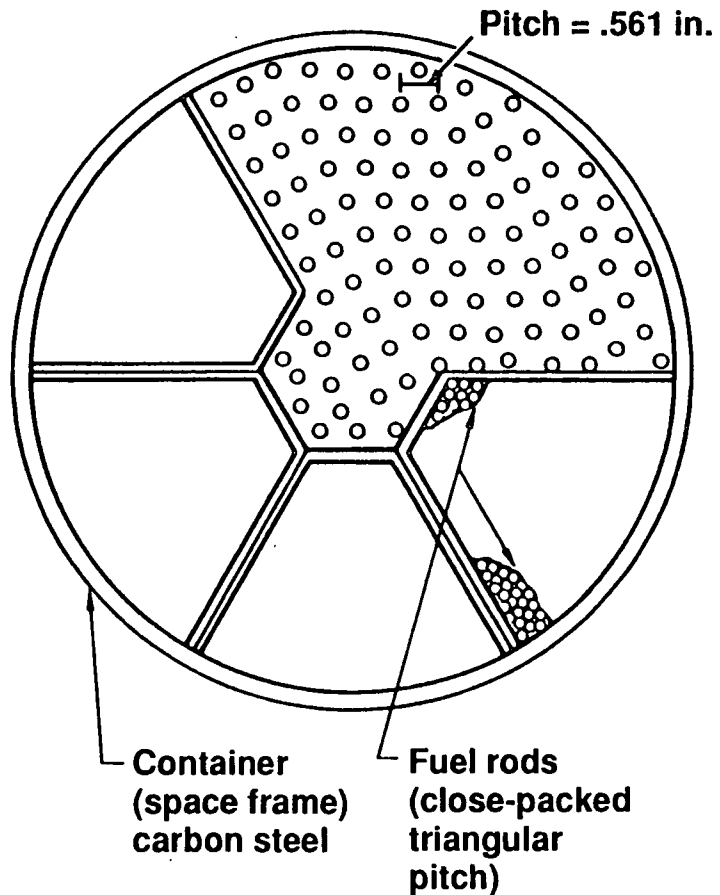
RESULTS OF CRITICALITY ANALYSES

CONFIGURATION NUMBER	CONFIGURATION	FUEL ENRICHMENT (wt% U^{235})	k_{eff}
1	NOMINAL CONFIGURATION - DRY	4.5	0.37
2	NORMAL CONFIGURATION - FLOODED	4.5	0.69
6	CONTAINER PARTIALLY GONE - OPTIMAL REARRANGEMENT	4.5	1.18
	OF RODS - FLOODED	2.0	1.00
		1.0	0.79
10	CLAD AND DISINTEGRATED PELLETS (POWDER) OPTIMALLY MIXED	4.5	1.16
	- FLOODED	1.6	0.95

CODE - KENO-IV

k_{eff} = EFFECTIVE NEUTRON MULTIPLICATION FACTOR

REF: UCRL-53595
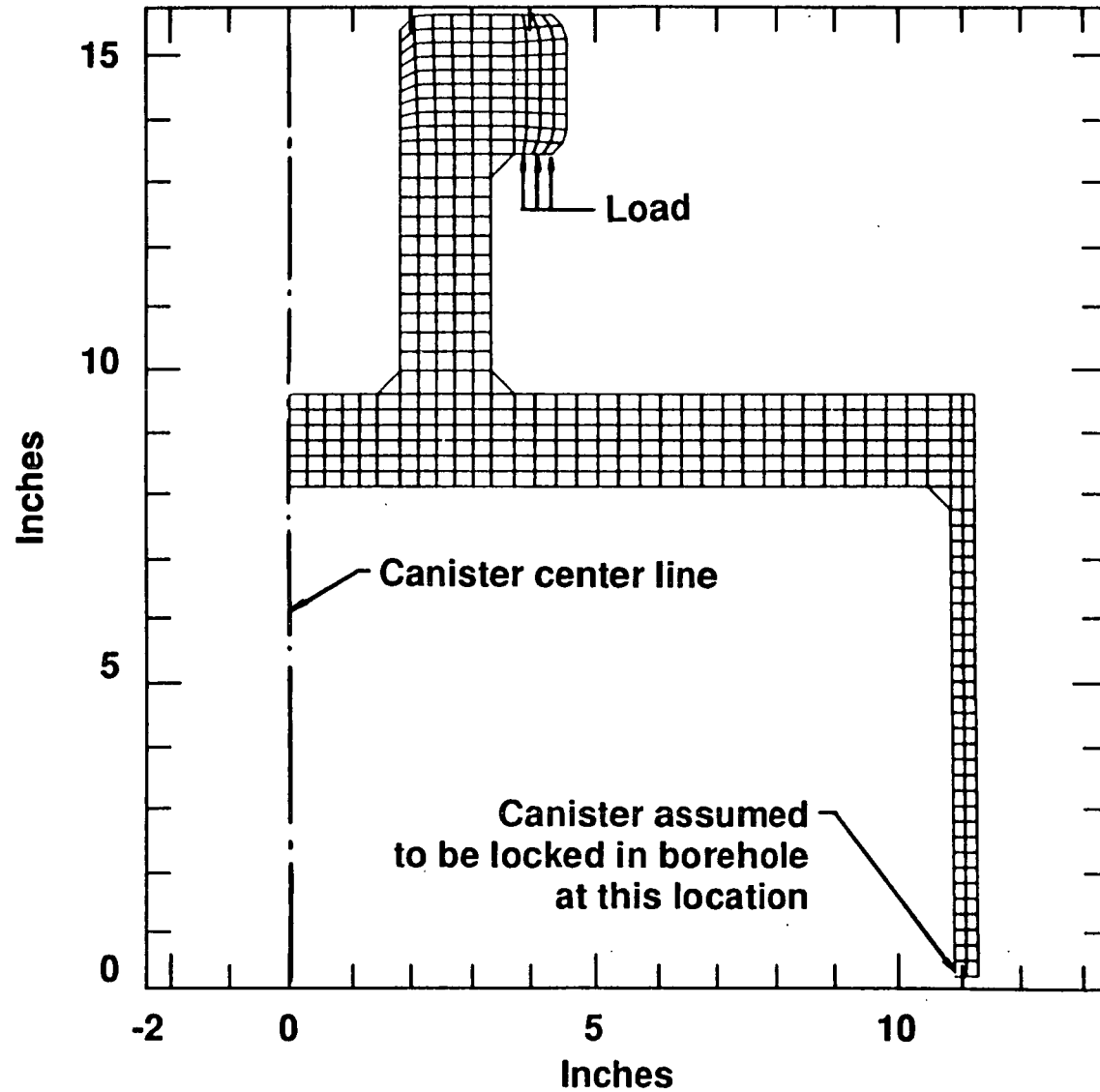
NUCLEAR CRITICALITY CONSIDERATIONS
(10 CFR 131)

CONCLUSIONS

- MUST BE ALLOWED TO TAKE CREDIT FOR BURN-UP TO SATISFY REQUIREMENTS

- MAY NEED TO INCORPORATE POISONS INTO CONTAINER DESIGNS TO SATISFY REQUIREMENTS

- BOTH OF THESE ALTERNATIVES REQUIRE REGULATORY INTERACTIONS AND PERHAPS REGULATORY CHANGES

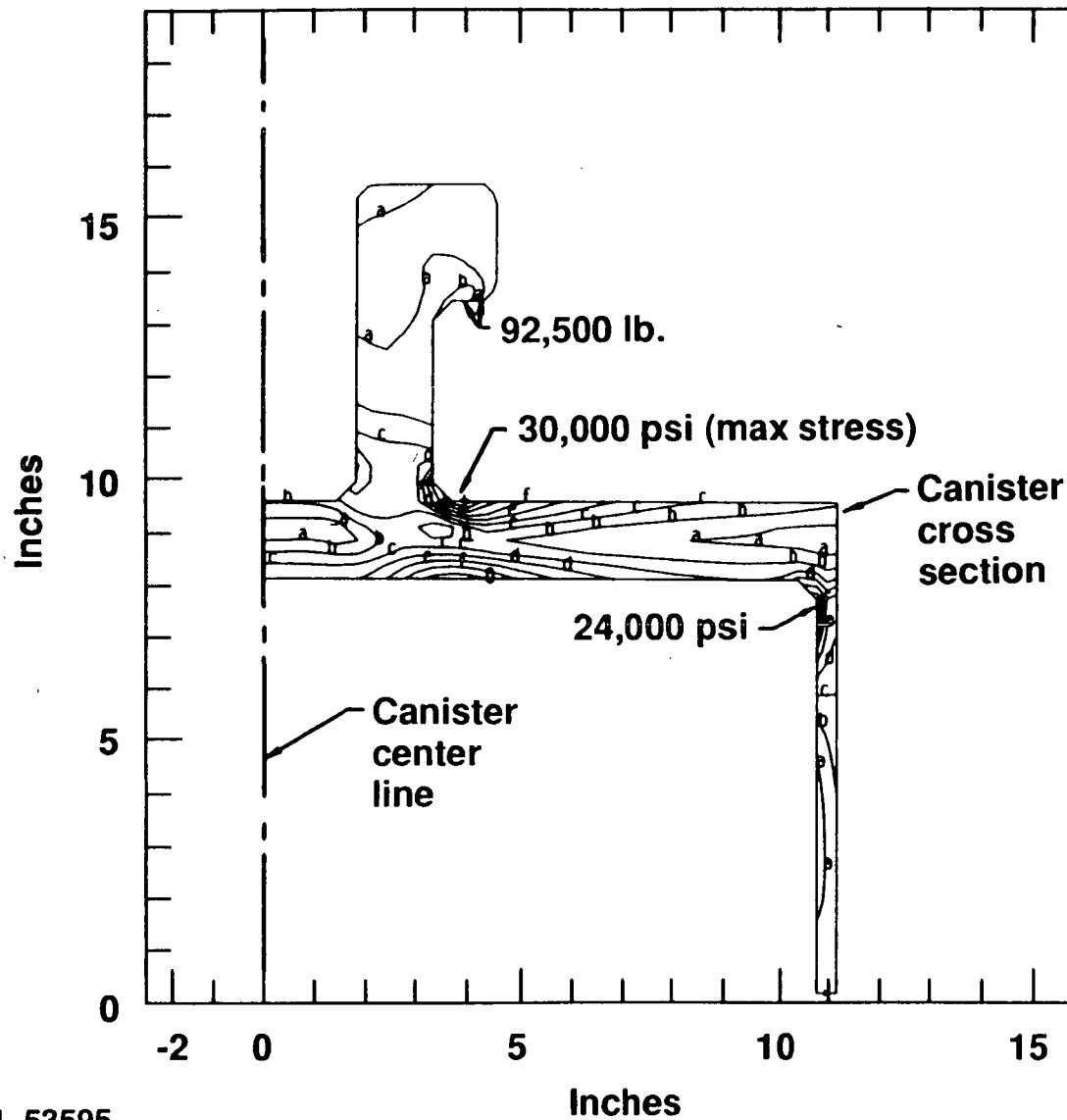# STRUCTURAL CONSIDERATIONS

- ## HANDLING & EMPLACEMENT OPERATIONS

- ## RETRIEVAL OPERATIONS

- ## ACCIDENT ANALYSES

FINITE ELEMENT MESH FOR RETRIEVAL STRESS CALCULATION

CALCULATED STRESS CONTOURS DURING RETRIEVAL

92,500 lb.

30,000 psi (max stress)

Canister cross section

24,000 psi

Canister center line

Inches

Inches

CALCULATED CANISTER DEFORMATION
FOR A SIMULATED DROP TEST