

Criticality Safety Analyses for Revision 5 of the 9977 SARP

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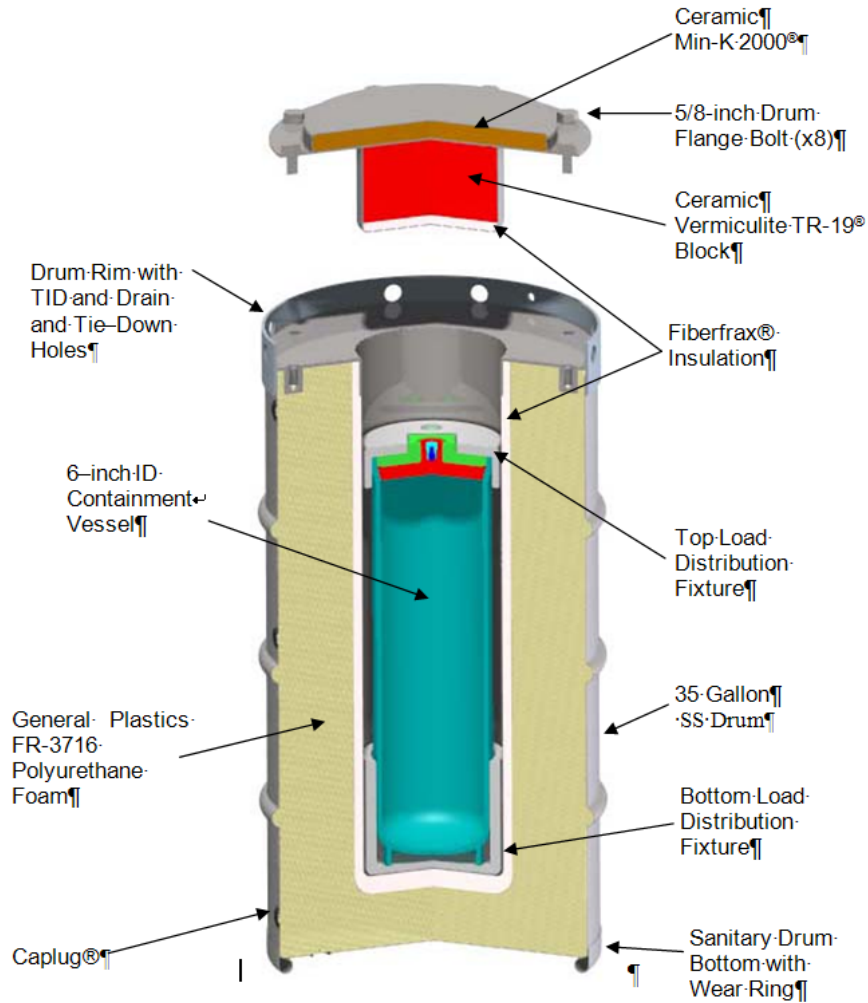
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The 9977 Shipping Package

- **History**
- **Contents**
 - Currently Approved
 - Included in SARP Revision 5
- **Single Unit Analysis**
- **Normal Condition of Transport Arrays**
- **Hypothetical Accident Conditions Arrays**

The 9975 Shipping Package



Contents Currently Approved For Shipment

Content Envelope	Description
77C.1	Heat Sources
77C.2	Np Pieces and Spheres
77C.5	Pu/U Metal
77C.6	Pu/U Metal
77C.7	Pu/U Metal in 6CV
77C.8	U Metal - 100% 235U
77C.9	U Metal - 95% 235U
77C.13	LANL OSRP
77C.14	INL AGR Fuel Compact
77C.15	Training Sources
77C.18	Dual Container Pu Oxide
77C.21	WRM Sources
77C.22	ZPPR Plates
77C.23	Dual 3013 Pu Metal

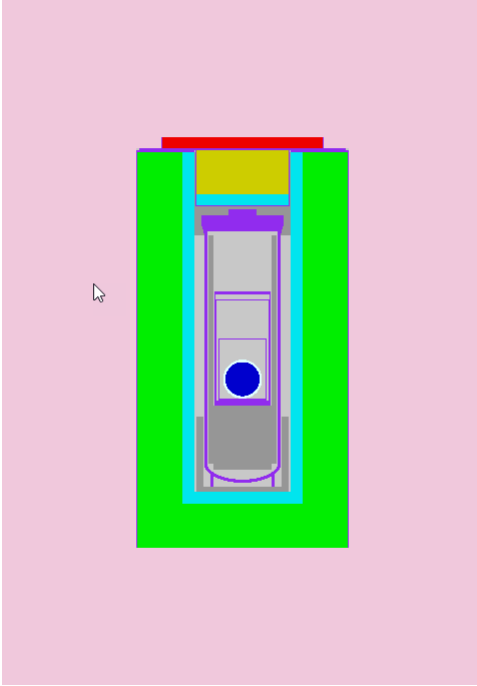
Contents Included in SARP Revision 5

Content Envelope	Description
77C.4	BeRP Ball
77C.14	INL AGR Fuel Compact
77C.16	Pu/U Metal – dose bounding
77C.17	Pu/U Oxide – dose bounding
77C.20	RSTD – U-Al Alloy

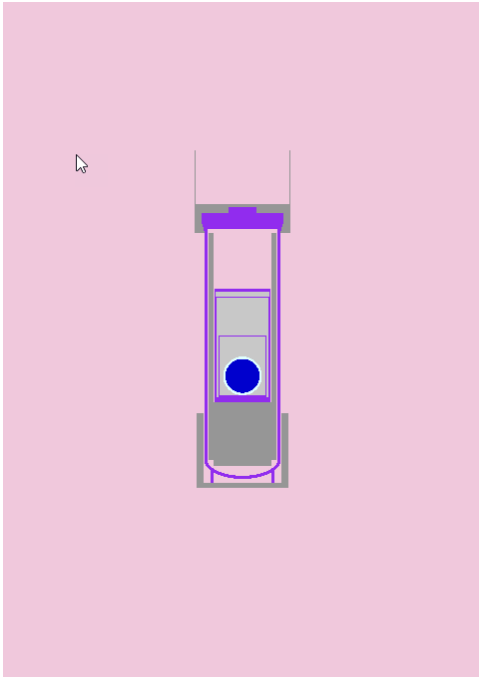
Single Unit Analysis

- A single 9977 package was modeled and surrounded by 30 cm of water on all sides
- The contents of the package are analyzed with and without the 3013
- The sphere of the fissile material was modeled placed in the radial center and elevated within the aluminum plug and sleeve positioned in the CV
- The radius of the fissile sphere and its vertical center are varied based on the selection of Pu or U as metal
- Some metal cases considered the presence of 100 g polyethylene as a spherical shell around the fissile material
- Additional calculations were performed flooding the CV, foam, vermiculite, Fiberfrax[®], and the Min-K[®] 2000, such that all non-metal regions of the package are replaced with water.
- Replace all metal outside the CV with water (CV Only cases)
- All SP cases reflected by 30 cm of water on all sides

Single Unit Analysis



Intact Single Unit

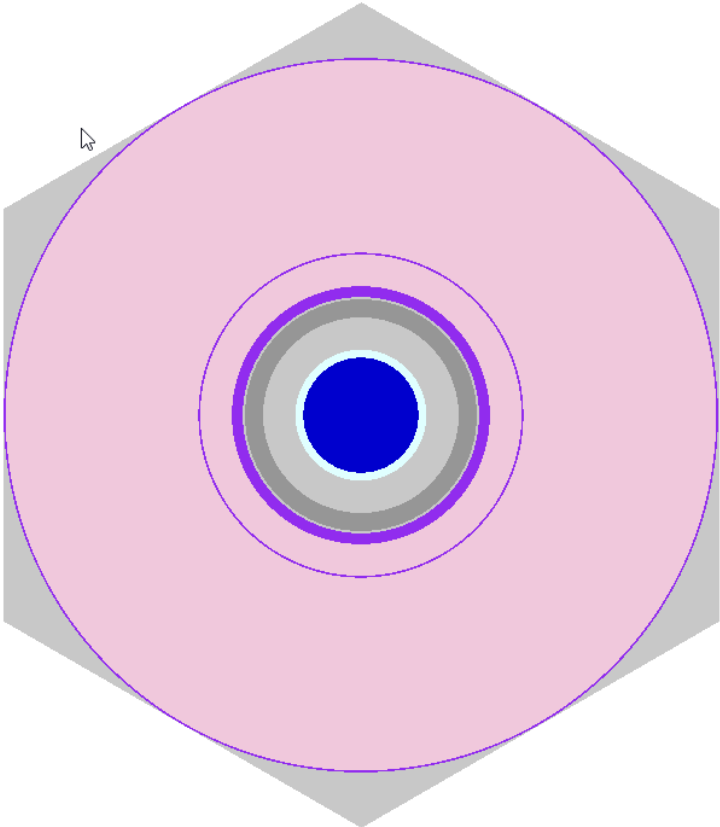


CV Only Single Unit

Normal Condition of Transport Arrays

- **Infinite, triangular pitched, array of packages**
- **Single 9977 package inside tight-fitting hexagonal prism with mirror boundary conditions**
- **Same configuration as the intact SP model**
- **Void between packages**
- **Infinite array of undamaged drums**

Normal Condition of Transport Arrays



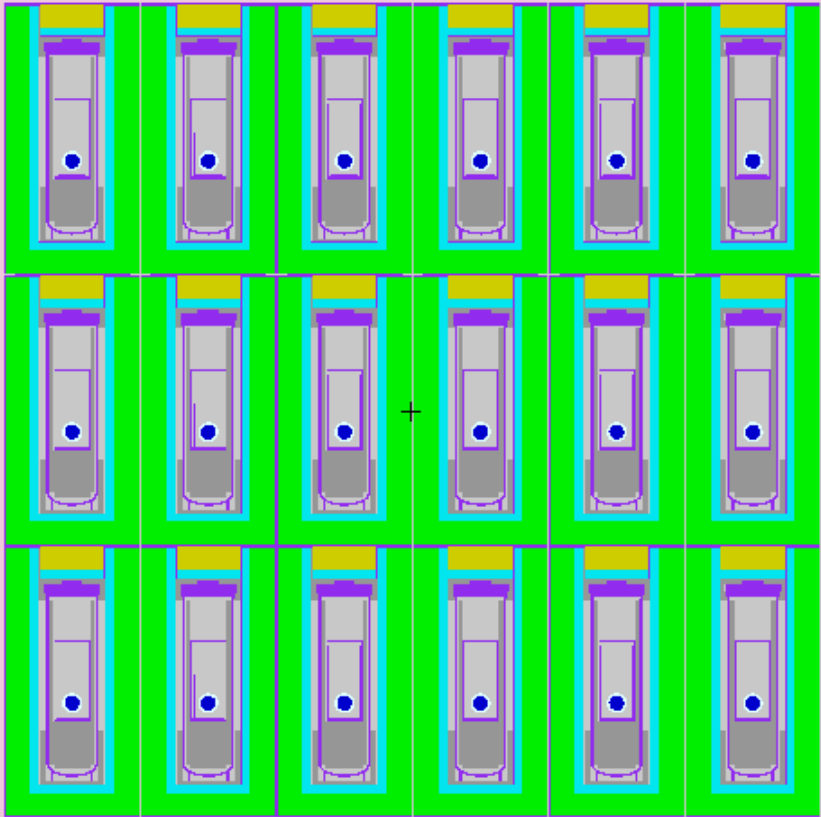
Hypothetical Accident Conditions Arrays

- **The HAC modelling starts with an infinite hexagonal (triangular pitched) array of damaged 9977 packages**
- **Each package contained a plutonium sphere, located at the bottom of the plug and sleeve, in the CV**
- **The reduced package dimensions used bound the maximum dents and bulges observed in localized areas on any of the packages following the completion of all accident testing**
- **To address the impacts of insulation damage during a fire some cases modeled the insulation replaced by void or water**

Hypothetical Accident Conditions Arrays

- **Several variations of the base case were modeled to examine: effects of**
 - 3013 container or SAVY Container
 - location of fissile material within the CV
 - polyethylene material
- **HAC models satisfy the prescribed requirements of 10 CFR 71.55.**
- **CV is modeled as dry based on test results that the CV tested leak tight before and after the immersion test**
- **Insulation conditions were studied by modeling water in the insulation regions of the package**

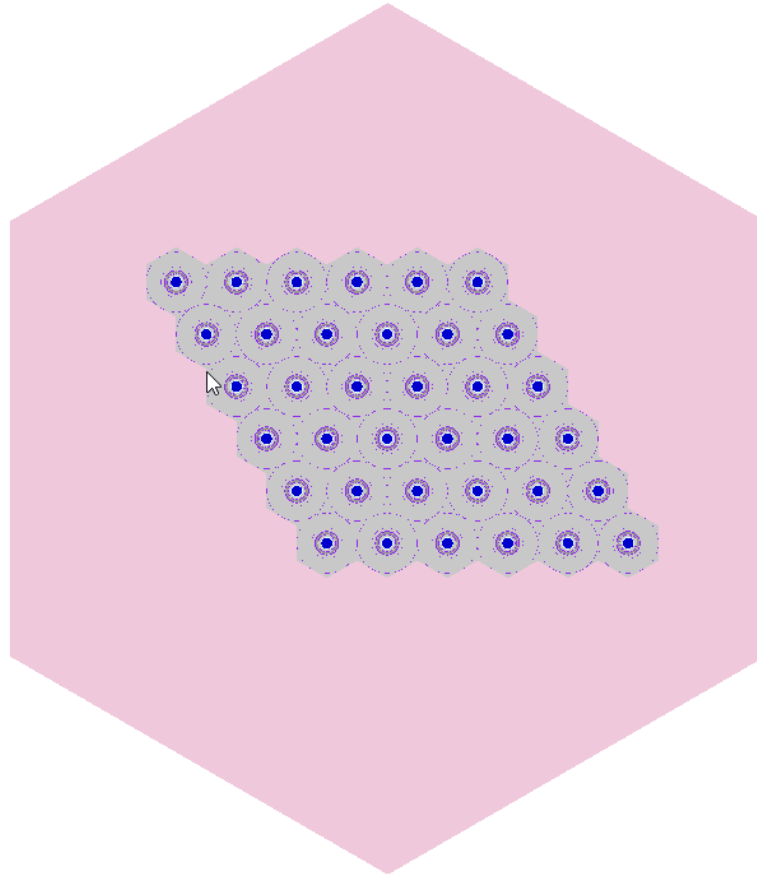
Hypothetical Accident Conditions Arrays



6 x 6 x 3 Array Section view

Hypothetical Accident Conditions Arrays

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6 x 6 3 3 Array Plan View

Questions