

American Centrifuge Plant

NRC/USEC Pre-Application Meeting

Nuclear Criticality Safety Calculation Validation

NRC Headquarters

Rockville, Maryland

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Introduction

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Agenda

- Purpose Jason Bolling
- Validation Effort/Results Jason Bolling
- Conclusion Jason Bolling

Purpose
Validation Effort/Results
Conclusion

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Purpose

- Provide information to NRC reviewers regarding USEC's validation of the SCALE 4.4a Monte Carlo reactivity code as it applies to planned American Centrifuge Plant (ACP) activities up to 10% U²³⁵ enrichment

Validation Effort

- Validation for PC-SCALE 4.4a performed for ACP
 - Includes 149 benchmark cases
 - Performed with 238-Group Cross Section Library
 - Utilized NUREG/CR-6698, “Guide for Validation of Nuclear Criticality Safety Computational Methodology,” January 2001
 - Included enrichment ranges from 2% to 30%

Validation Effort (Cont.)

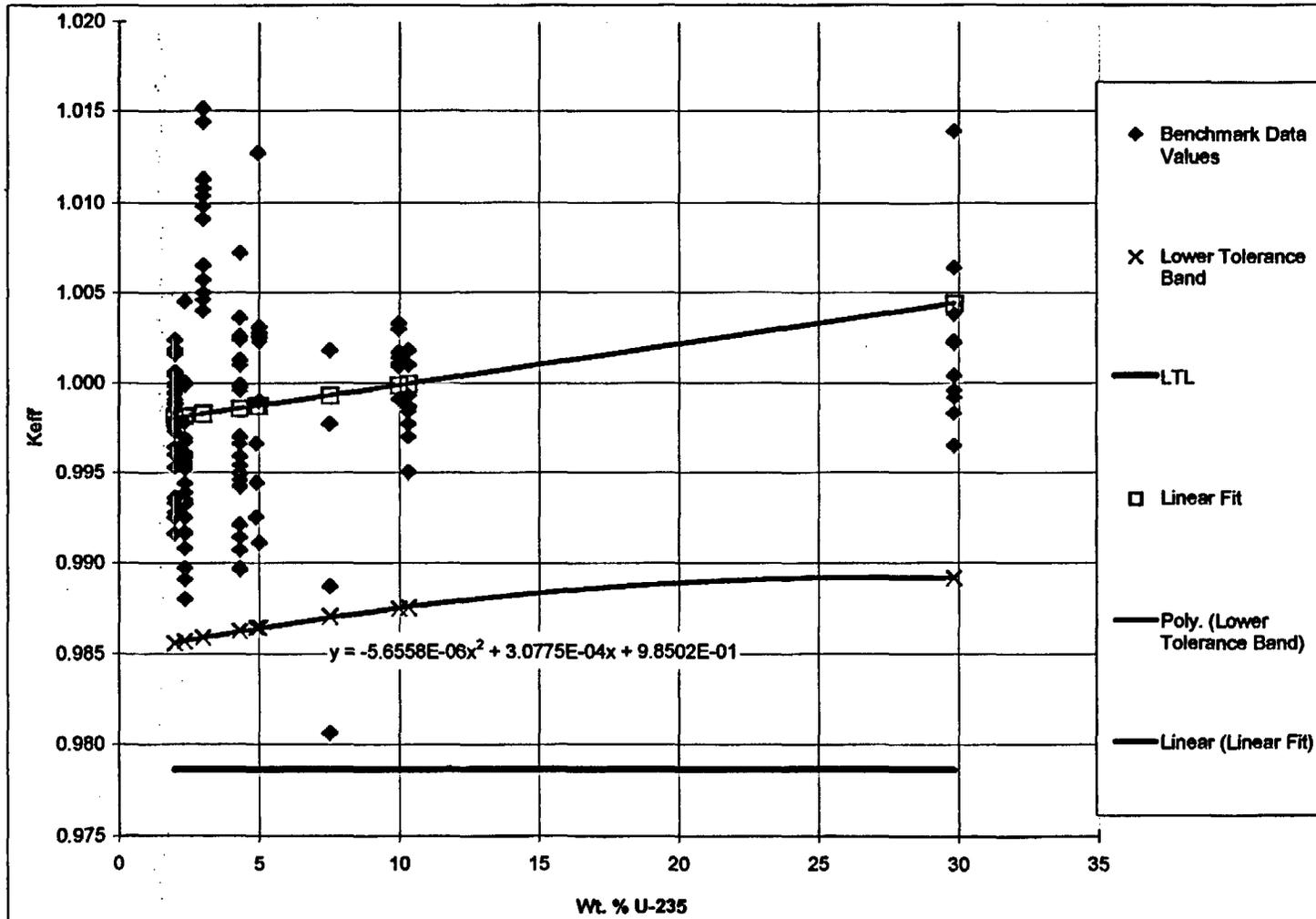
- ACP validation cases included relevant benchmark cases, at 30% and below, from the gaseous diffusion plant (GDP) validation
- GDP validation methodology and benchmark cases from 5% to 10% accepted by NRC
- Safety basis calculations for ACP were performed at 10% enrichment, except 10-ton product cylinder operations performed at 5%

Validation Results

- Area of Applicability for ACP Validation -

Fissile Material	Enrichment	Moderator	Reflector	Upper Safety Limit
UO ₂ U ₃ O ₈ UO ₂ (NO ₃) ₂ UO ₂ F ₂ UF ₄ UF ₆	1-30 wt. % U ²³⁵	Water Paraffin	None Water Steel Lead Concrete Paraffin Polyethylene	0.955

Validation Results (Cont.)



k_{eff} vs. Wt. % U^{235} (238-Group Library) - 2% - 30% U^{235}

Validation Results (Cont.)

- Upper Safety Limit -

- Lower tolerance limit (LTL) was calculated using the most conservative subset of the 149 benchmark cases
- The LTL is valid within the Area of Applicability range

Validation Results (Cont.)

- Materials of Construction -

- The materials of construction expected for the ACP are adequately represented by the materials present in the benchmark experiments

Conclusion

- Utilized NUREG/CR-6698 for validation
 - Performed with 238-Group Cross Section Library
 - Sufficient benchmark cases available
- Validation demonstrates adequate margin of safety applied to calculations for enrichments up to 10% U²³⁵