December 17, 1996

MEMORANDUM TO: David B. Matthews, Chief
Generic Issues and Environmental
Projects Branch
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

FROM: Egan Y. Wang, Reactor System Engineer Original Signed By:
Generic Issues and Environmental
Projects Branch
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

SUBJECT: MEETING SUMMARY OF DECEMBER 12, 1996, REGARDING CONTROL ROD INSERTION ISSUES

On December 12, 1996, representatives of Siemens Power Corporation (SPC) met with representatives of the Nuclear Regulatory Commission (NRC). Participants of this meeting also include representatives from Texas Utility Electric Company (TU), Carolina Power and Light, and Wisconsin Public Service. The purpose of this meeting was to provide an opportunity for SPC representatives to review and discuss control rod insertion issues. SPC representatives provided an introduction and a brief description on current activities with regard to the issues. Representatives from TU presented data for both fuels from Siemens and Westinghouse.

Most of the meeting involved presentation of proprietary information. Attachment 1 provides a list of meeting attendees. Attachment 2 is the non-proprietary version of the presentation material. Attachment 3 is the material presented by TU representative.

Attachments: As stated

cc w/att: See next page

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OFC	PGEB	SC:PGEB	C:PGEB
NAME	EWang:sw	FAkstulewicz	DMatthews
DATE	12/16/96	12/17/96	12/17/96

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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cc w/att: see next page

NRC/SIEMENS POWER CORPORATION MEETING
ON CONTROL ROD INSERTION ISSUES
LIST OF ATTENDEES
Dec 12, 1996

NAME	ORGANIZATION
Hansen, Leo E.	Siemens
Reparaz, Adolfo	Siemens
Perkins, Richard	Siemens
Copeland, R. A.	Siemens
Woodlan, Don	TU Electric
Cheo, Whee	TU Electric
Wanner, Dave	Wisconsin Public Service
Davis, Dan	Carolina Power & Light
Weiss, Eric	NRC/NRR/DSSA/SRXB
Conrad, H. F.	NRC/NRR/DE/EMCB
Grubelich, F. T.	NRC/NRR/DE/EMEB
Chatterton, M.	NRC/NRR/DSSA/SRXB
Rajan, J.	NRC/NRR/DE/EMEB
Wang, Egan	NRC/NRR/DRPM/PGEB

ATTACHMENT 1

DISTRIBUTION: Mtg. Summary of December 12 Meeting with Siemens Power Corporation Dated December 17, 1996

HARD COPY
Central File
Public
PGEB r/f
R. Cooper, RI
E. Merschoff, RII
W. Alexion, RIII
J. Dyer, RIV
E. Wang
OGC
ACRS

E-MAIL
F. Miraglia
A. Thadani
R. Zimmerman
T. Martin
E. Jordan
D. Matthews
F. Akstulewicz
E. Weiss
H. F. Conrad
M. Chatterton
J. Rajan

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NRC Meeting on Control Rod Insertion

Siemens Power Corporation

December 12, 1996

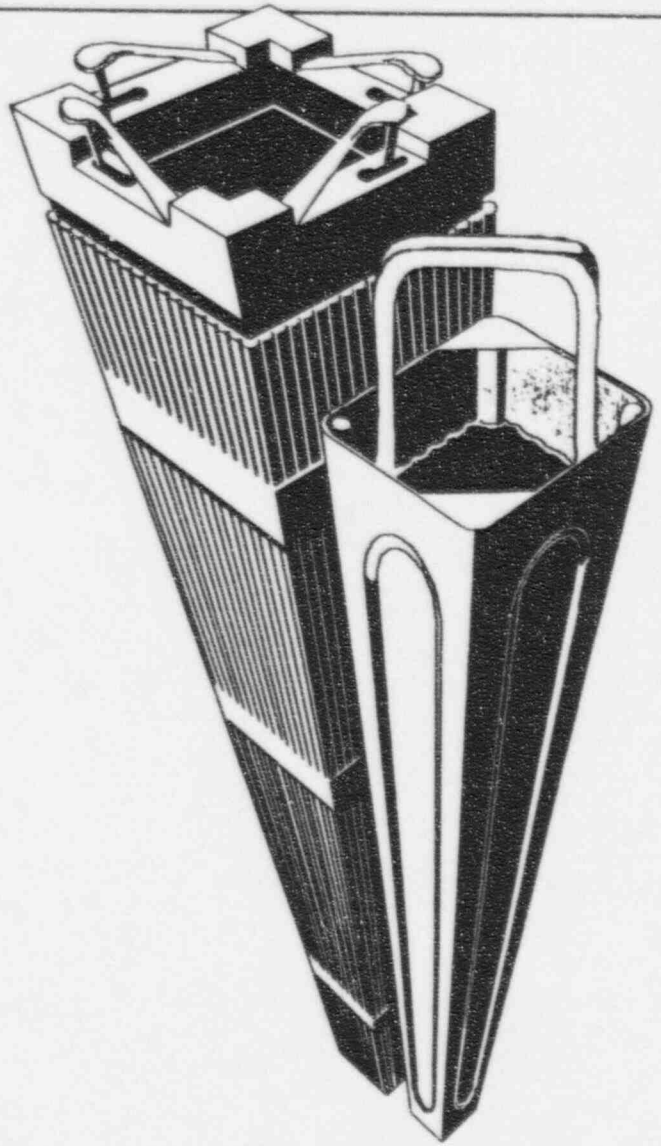
Meeting Purpose: Describe SPC Guide Tube Design Process and Recent RCCA Issue

- Demonstrates no operational guidelines needed on SPC fuel
- SPC wants to identify the NRC issues and respond with generic submittal
- SPC design addresses guide tube growth, buckling, and mechanical compatibility with core structure
- Review of information available on recent RCCA insertion delays and SPC operational experience:
  - shows the SPC designs maintain adequate clearance for unrestrained RCCA insertion
  - conservative relative to assemblies where delays seen

Agenda

- Introduction--RA Copeland
- Description of SPC Design Process--A Reparaz
- SPC Design Validation--A Reparaz
- Conclusions--A Reparaz
- Utility Activities/Reviews--Utilities
- Follow-on Activities--All

Siemens Presentation on RCCA Insertion Compatibility for Westinghouse Reactors



A. Repáraz, Manager
Product Mechanical Engineering
Siemens Power Corporation - Nuclear Division

Outline of SPC Presentation on RCCA Insertability

- Problem Statement
- SPC Experience
- SPC Design Considerations
- Manufacturing Controls
- SPC Growth Data
- Operating Considerations
- Drop/Drag Measurement Data

Root Cause Conclusions*

All conclusions are based upon Westinghouse data and models for Westinghouse fuel

- The incomplete RCCA insertions observed at Wolf Creek have been caused by excessive compressive loads on the fuel assembly guide thimble tubes leading to excessive thimble tube distortion.
- For Wolf Creek, the increased compressive load was caused by unusual fuel assembly growth over and above what would normally be expected as a result of irradiation exposure.
- The unusual growth component is a combination of growth due to oxide accumulation and accelerated growth, both of which are temperature sensitive.
- The unusual growth is observed only in high temperature plants on those high burnup fuel assemblies that have certain types of power histories.

*Note: This page taken from the Westinghouse presentation on the "Root Cause of Incomplete Control Rod Insertions at Westinghouse Reactors," Sumit Ray, Westinghouse Commercial Nuclear Fuel Division

SPC Experience

- No indication of slow or incomplete RCCA insertion has ever been reported in any SPC fuel
- SPC fuel assembly exposure experience in controlled positions:

[

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SPC Fuel Assembly Design Considerations

- Assembly design assessments include:
  - [

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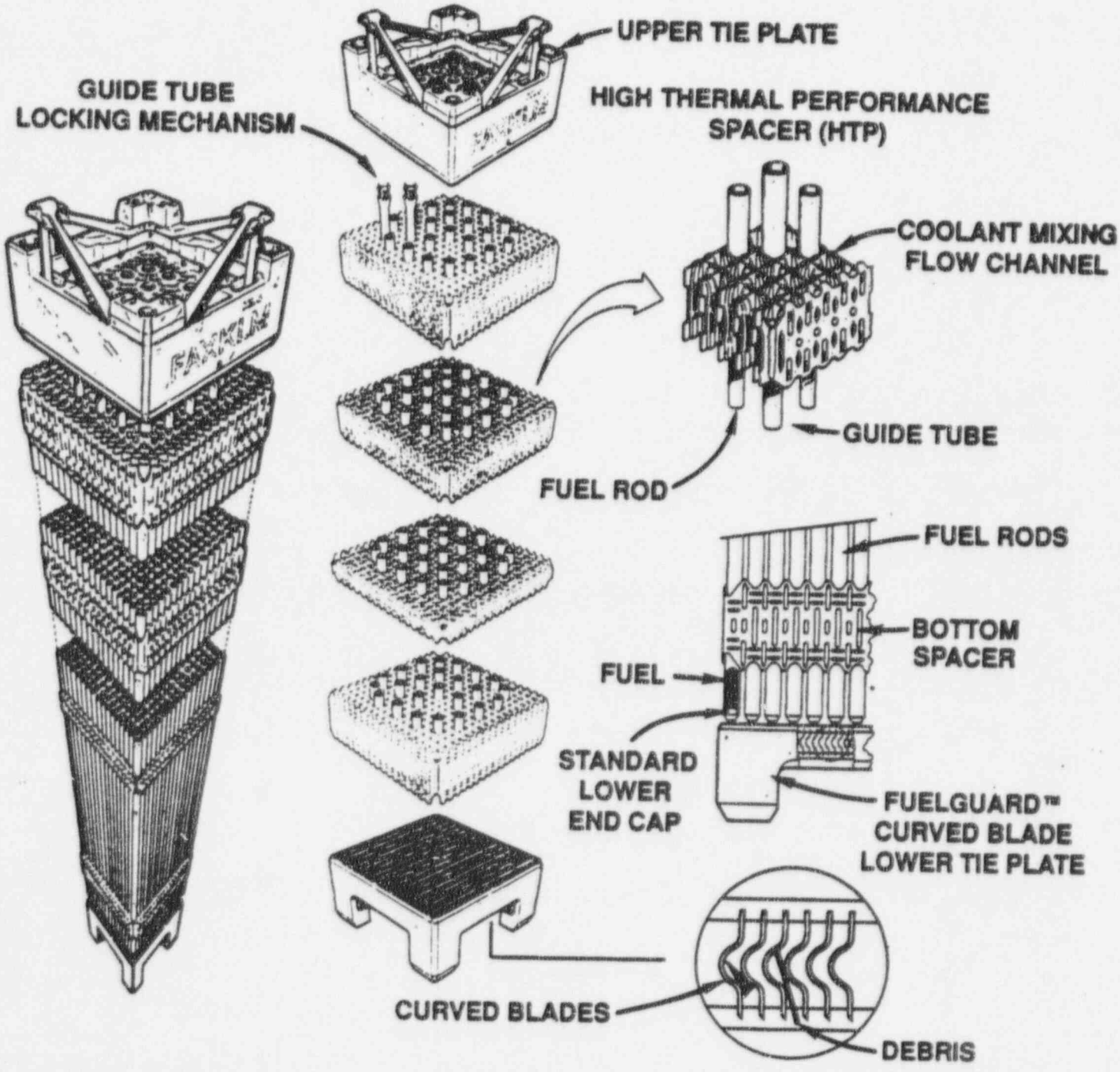
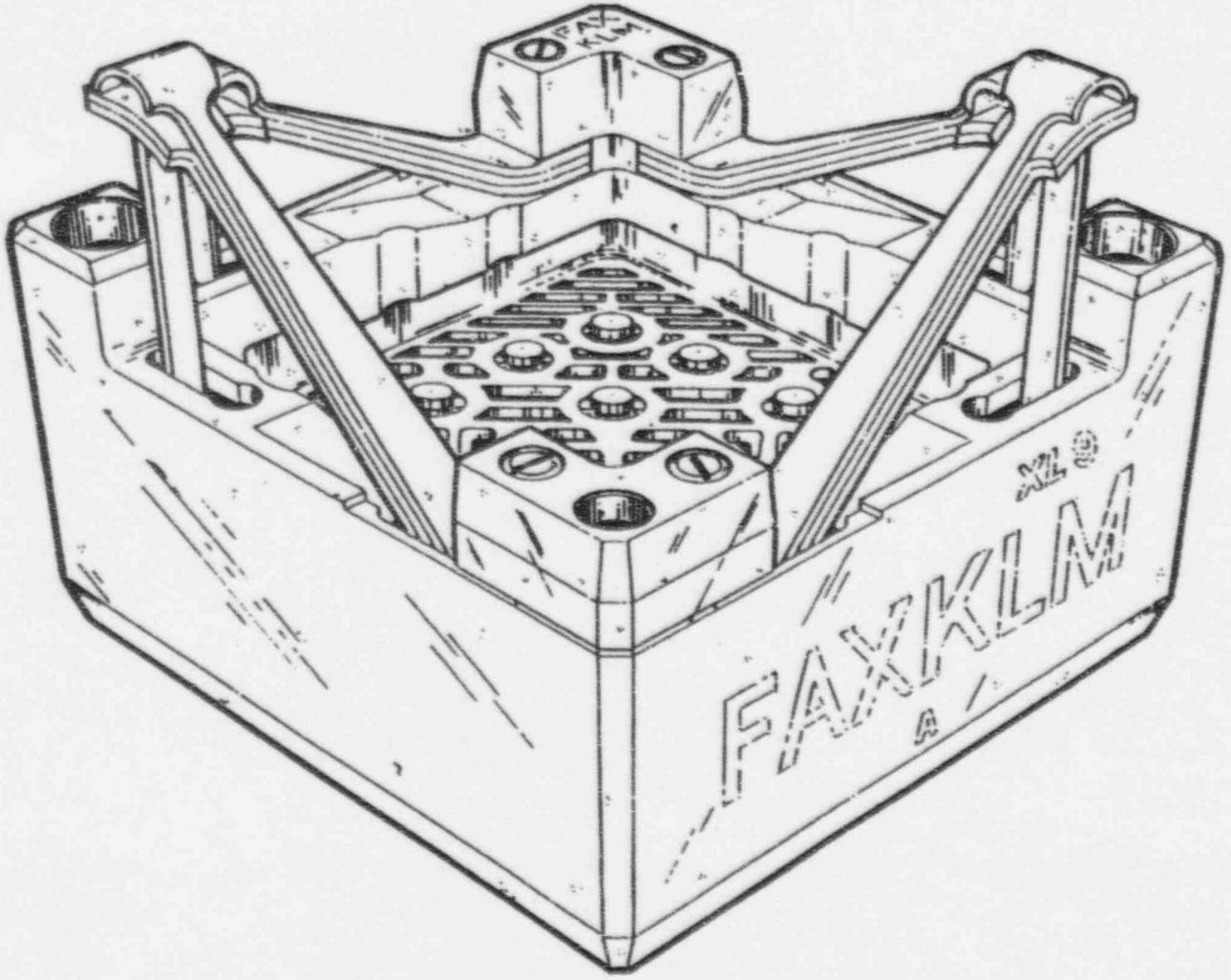
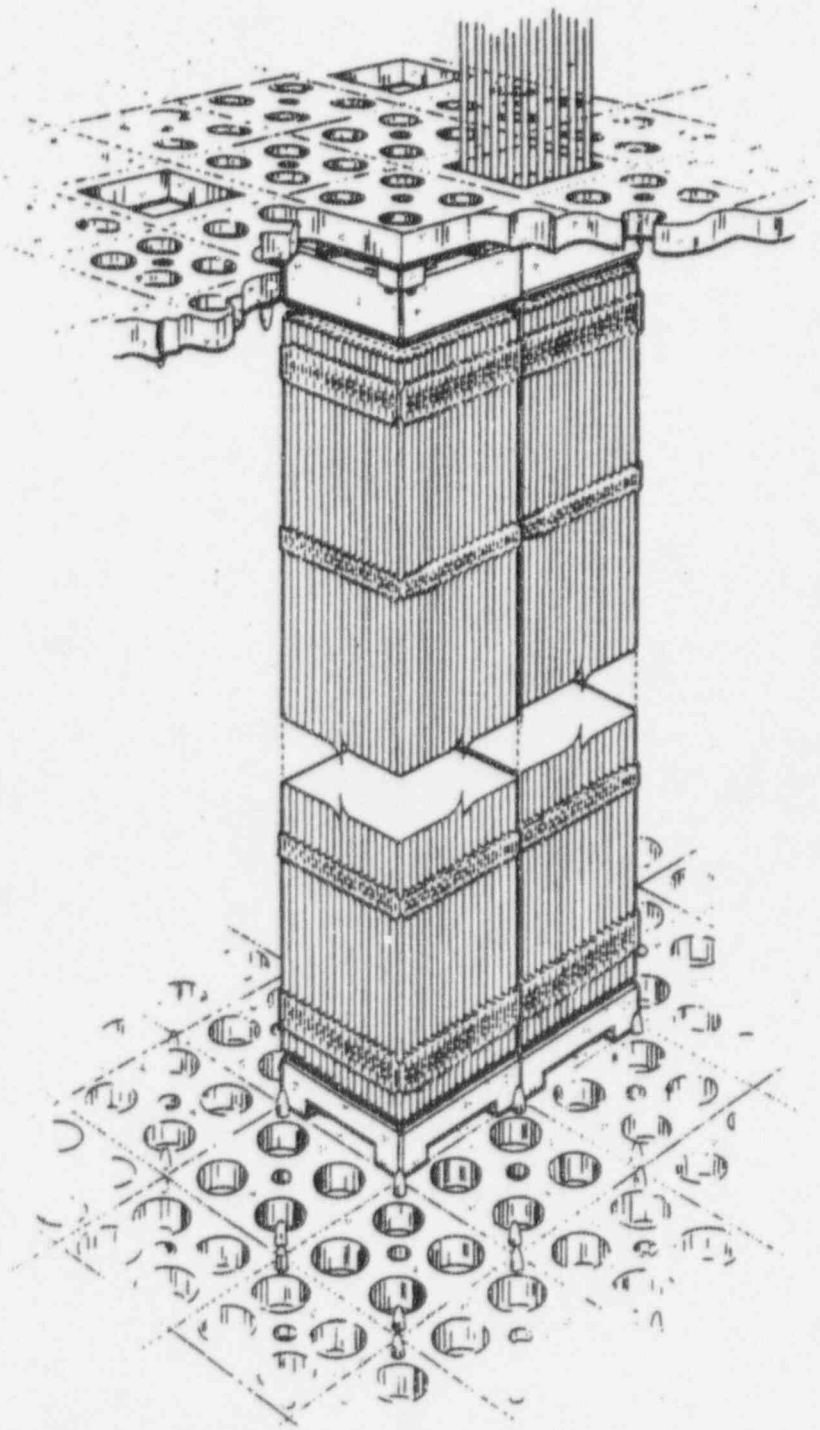
HTP 17x17 PWR Fuel Assembly



Detail of Upper Tie Plate Design



Assembly in the Core



Detail of Upper Core Interface

[

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Typical SPC Fuel Assembly Growth Allowances

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Core Structure Compatibility

- [

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Potential Interference Points

[

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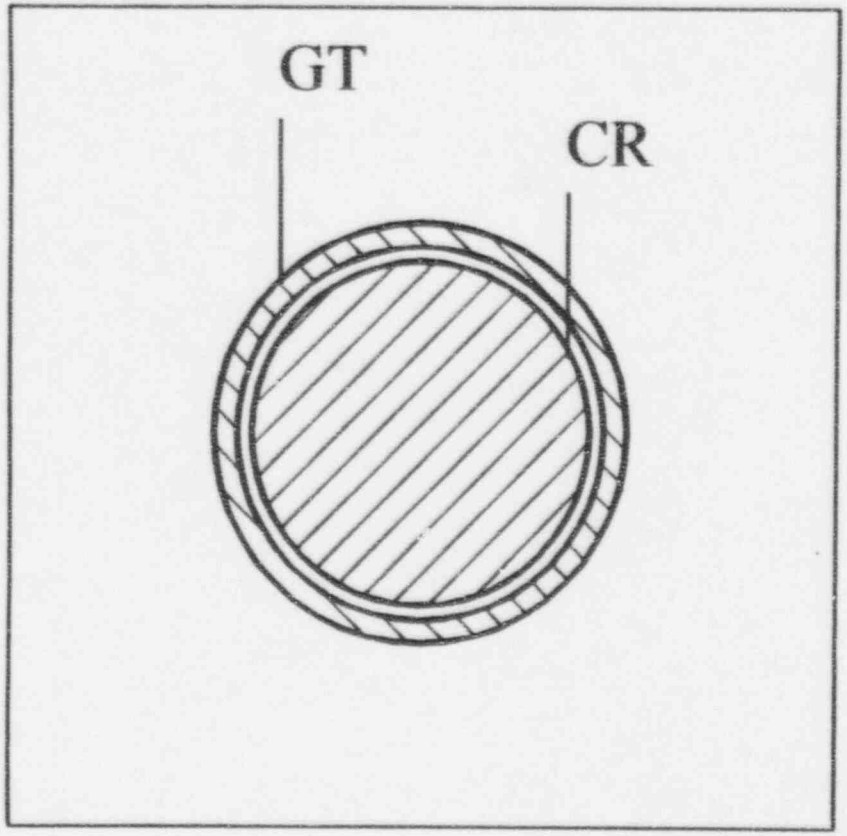
Typical Westinghouse Guide Tube Dimensions



SPC has more clearance and slightly more cross-sectional area and buckling strength.

Typical guide tube dimensions follow.

Typical 14x14 Guide Tube Dimensions

Item	Westinghouse Value	SPC Value	SPC Delta
[			]

Typical 15x15 Guide Tube Dimensions

Item	Westinghouse Value	SPC Value	Delta wrt SPC
[			]

Typical 17x17 Guide Tube Dimensions

Item	Westinghouse Value*	SPC Value	Delta wrt SPC
[			]

* Westinghouse V5H fuel assembly design

SPC Design Considerations

Factors that affect straightness of guide tube during irradiation:

- [

]

SPC Design Considerations (cont.)

Parameters which affect the growth of guide tubes:

- [

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SPC Design Considerations (cont.)

SPC fuel design features that affect guide tube growth and straightness

- [

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Corrosion/Hydriding Levels for Structural Components

- [

]

Typical Measured Guide Tube Oxide Thickness (Siemens, KWU)

[

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Guide Tube Buckling Calculations

- [

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SPC Drag Test Setup

[

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SPC Drag Test Using a Simulated RCCA and Typical 17x17 Cage Assembly (Test #1, Spacers and IFMs Bracketed)

[

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SPC Drag Test Using Simulated RCCA and Typical 17x17 Cage Assembly (Test #2, HTP Spacer Bracketed Only)

[

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Typical 17x17 Holddown Spring Force and Guide Tube Strength Characteristics

[

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Assembly Growth

- Assembly growth is conservatively calculated for maximum holddown load and axial clearance calculations
- [

]

Assembly Growth (cont.)

- [

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SPC Growth Model Development

- [

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SPC Growth Model Development (cont.)

- [

]

Measured CE Design Fuel Assembly Growth

[

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Measured CE Design, with Guide Bars, Fuel Assembly Growth

[

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Measured Westinghouse Design Fuel Assembly Growth

[

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SPC Design Growth Curve for Westinghouse Type Fuel Assemblies

[

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Measured Fuel Rod Growth

[

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Calculated Irradiation Growth

[

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Design Summary

- [

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RCCA Drop Time and Drag Results

- RCCA drop time and drag results show excellent behavior with no identifiable trends with burnup

RCCA Drag Force 14x14

[

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RCCA Drop Times 14x14 SPC Fuel Assemblies

[

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RCCA Drag Force in Dashpot 15x15

[

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RCCA Drop Times 15x15 SPC Fuel Assemblies

[

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17x17 Drag Data

[

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RCCA Drop Time to Dashpot 17x17

[

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RCCA Drop Time 17x17

[

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RCCA Drop Times 17x17

[

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Conclusion

- SPC utilizes appropriate methodology and allows adequate design margins for control rod insertion as demonstrated by the in-reactor validation data.
- SPC designs are compatible with RCCAs at all burnups. No burnup restrictions or additional data collection are required for SPC fuel in control positions in Westinghouse design reactors.

Follow-on Activities

- SPC will submit a letter:
  - Describing designs and design bases that preclude RCCA insertion problems
  - Showing operation is within SPC experience
  - Providing reactor RCCA testing to support SPC conclusions
- NRC Actions

TU Electric - Comanche
NRC Presentation on 12-

SPC Control Rod Insertion Issues

TU ELECTRIC

Attachment 3

CPSES Current Status

- **UNIT 1**
  - Highest burnup fuel in rodded locations to date:
    - SPC fuel ~ 45 GWD/MTU (@EOC 5)
    - Westinghouse fuel ~ 42 GWD/MTU (@EOC 4)
  - Cycle 6 (current cycle) projected maximum burnups in rodded locations:
    - SPC fuel @EOC 6 ~ 50 GWD/MTU
    - Westinghouse @EOC 6 ~ 38 GWD/MTU

CPSES Current Status (cont.)

- UNIT 2
  - Highest burnup fuel in rodded locations to date:
    - SPC fuel - None currently
    - Westinghouse fuel ~ 34 GWD/MTU (EOC 2)
  - Cycle 3 (current cycle) projected maximum burnups in rodded locations:
    - SPC fuel - None @EOC 3
    - Westinghouse fuel ~ 46 GWD/MTU @EOC 3

CPSES Current Status (cont.)

- There have been no indications to date of any control rod insertion problems in any fuel assemblies at CPSES.
  - All rod drop measurements were as expected and within acceptable limits.
  - All control rod drag measurements were as expected and within acceptable limits.
  - All control rods have fully inserted when tripped.

EOC Control Rod Drag Data

- U1-EOC5 and U2-EOC2 dashpot drag values well below the 100 lb. criteria as shown in attached Figure 1 with no evidence of any upward trend to date.

- U1-EOC5 dashpot drag vs. upper guide tube drag shows SPC and Westinghouse fuel well within lower left quadrant of graph as shown in attached Figure 2.

SPC Fuel Design Comparison

- SPC fresh fuel assembly clearance allowance to the upper core plate is greater than Westinghouse V5H and OFA fuel.

- SPC assembly growth allowances accounts for "accelerated growth" and is consistent with Wolf Creek 's measured accelerated growth.

FIGURE 1 - W & SPC RCCA Dashpot Drag vs. Burnup

CPSES - Measured During Unlatching Process

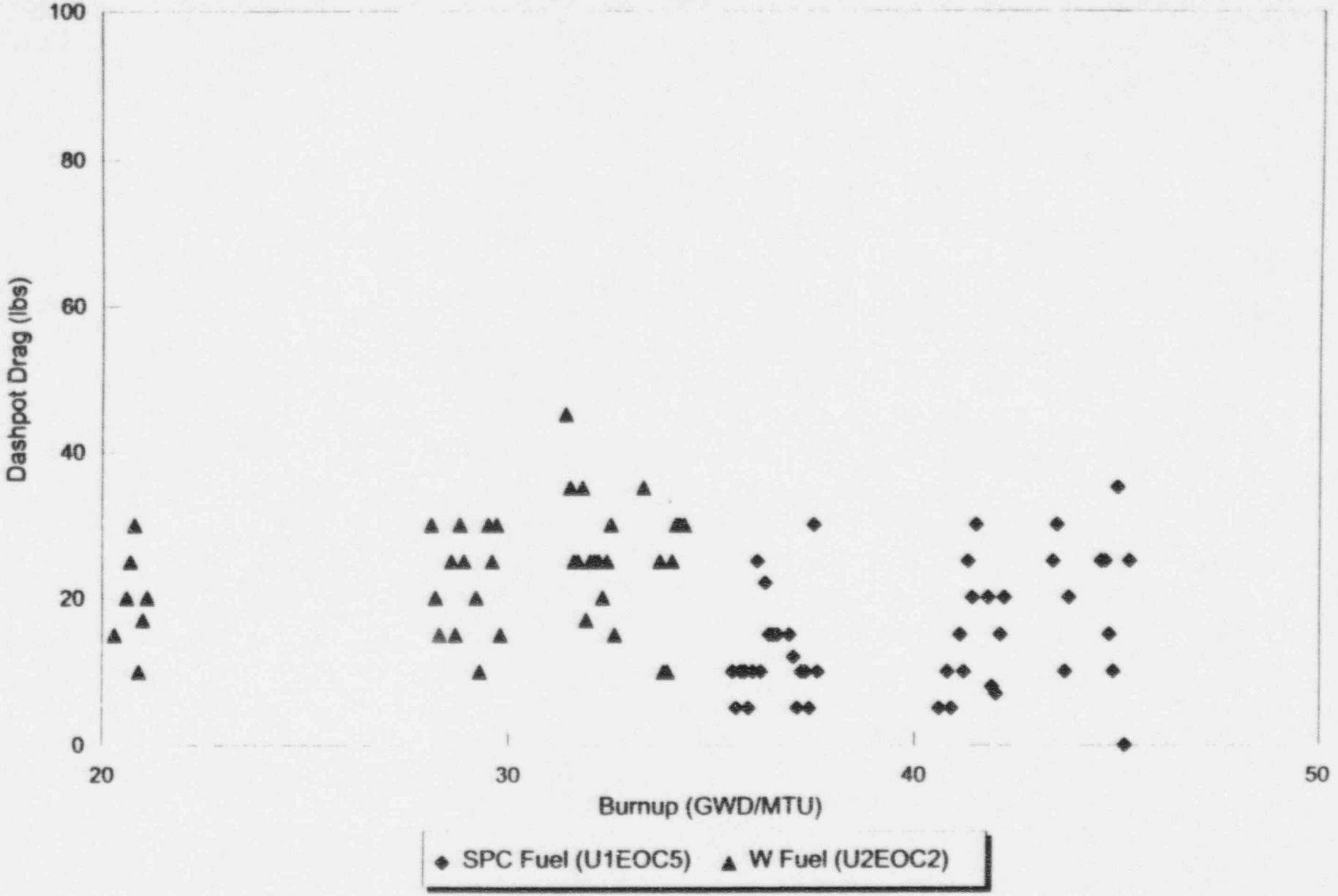
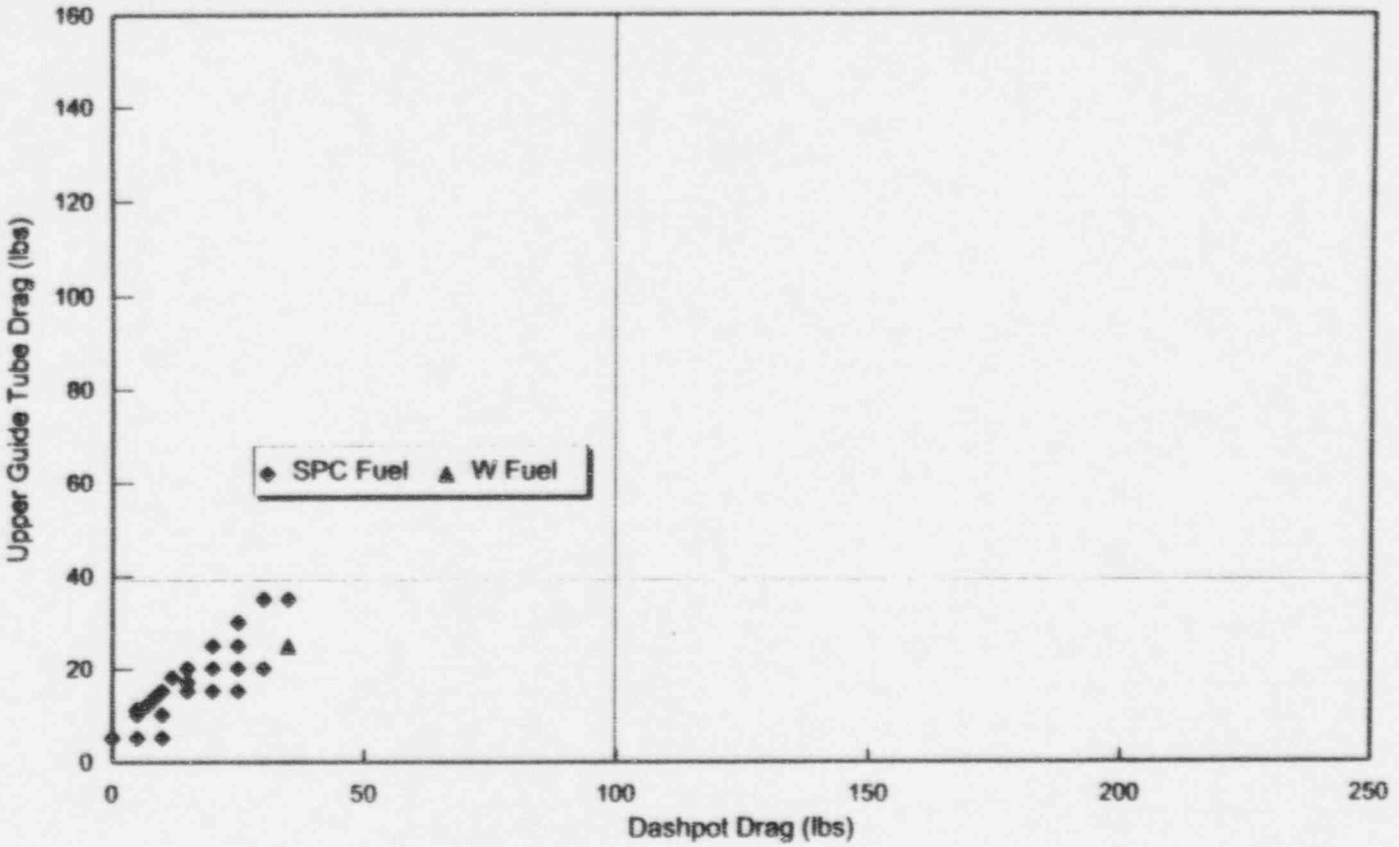


FIGURE 2 - Unit 1 RCCA Drag - (upper guide tube vs. dashpot)

During UNLATCHING Process @EOC5



cc:

Mr. H. D. Curet, Manager
Product Licensing
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